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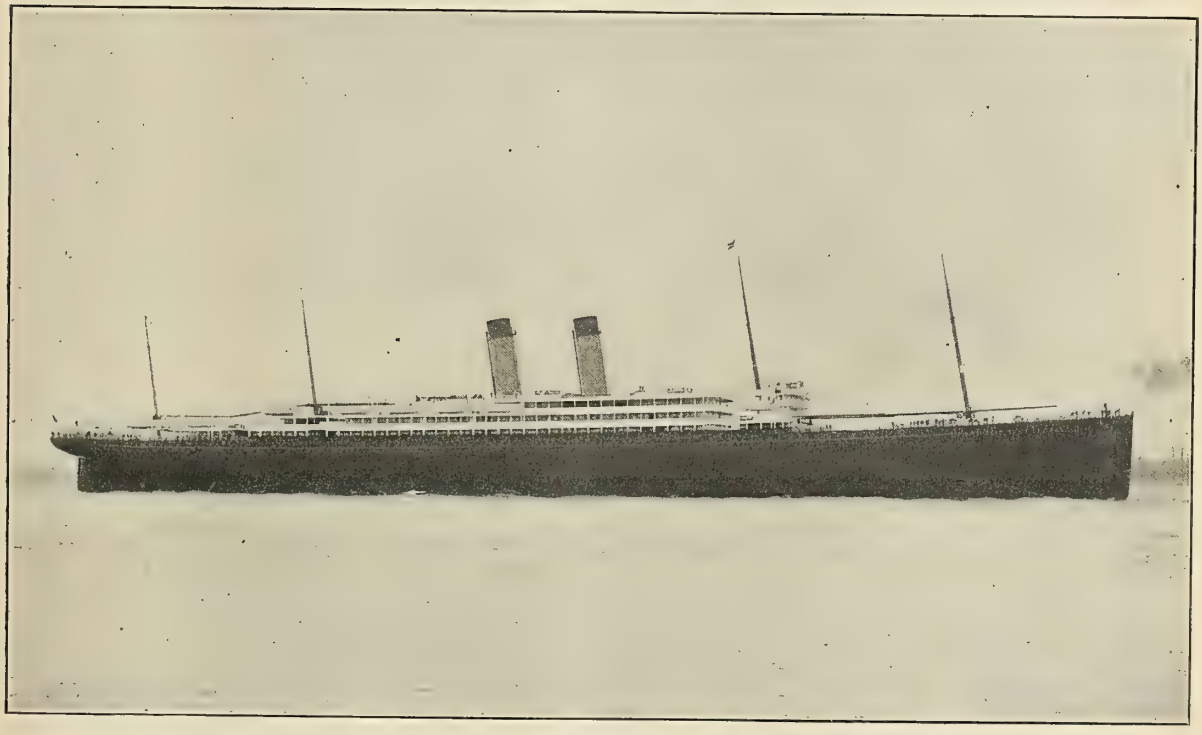
TWIN-SCREW STEAMSHIP BALTIC, OF THE WHITE STAR LINE, THE LARGEST SHIP AFLOAT.

The White Star line has again demonstrated its intention to operate steamers of the largest type by placing in commission the new steamer *Baltic,* the largest ship afloat. In the *Cedric* and *Celtic* this line possesses two steamers which have held the record as the largest steamers, but the *Baltic,* registering 24,000 tons, exceeds them by 3,000 tons. The cargo capacity is about 28,000 tons, and the displacement at normal draft about 40,000 tons. The ship is 726 feet long, or 26 feet longer than the steamers above named, and with her two funnels and four pole masts she strongly resembles them.



NEW TWIN-SCREW STEAMSHIP BALTIC, OF THE WHITE STAR LINE, THE LARGEST SHIP AFLOAT.

The Baltic, which completed a successful maiden voyage from Queenstown to New York on Friday, July 8, was turned out from the yard of Harland & Wolff, Belfast, builders of all the recent White Star steamers. There are in all six steel decks, up to and including the weather or shelter deck, and above this is built amidships a large deck house with three promenade decks extending the full width of the ship. The other deck erections will be mentioned later. The shell plating is laid in inside and outside strakes, and the three strakes between main and upper decks are doubled. In appearance the sides of the ship are notable for the absence of ports, for outside of the coaling ports there are but one port with swinging doors forward and one aft on each side. The framing throughout is of channels, which section is also largely used for deck beams.

In describing this ship we will first briefly mention the arrangement from forward aft, of the hatches, masts, deck erections, and the numerous cargo-handling machinery with which the ship is so completely equipped. A double Napier windlass is placed in the forecastle and in addition drives two capstans' heads. The enormous anchors are of the stockless type. Directly aft is a winch with extended shaft for gypsy heads, made by J. H. Wilson & Company. Next comes hatch No. 1, with two winches at the after side, then the foremast with four cargo booms. Next two winches are placed for working hatch No. 2, at the after end of which is also another winch. Hatch No. 3 has two winches on the after side, close to first deck erection, which is the

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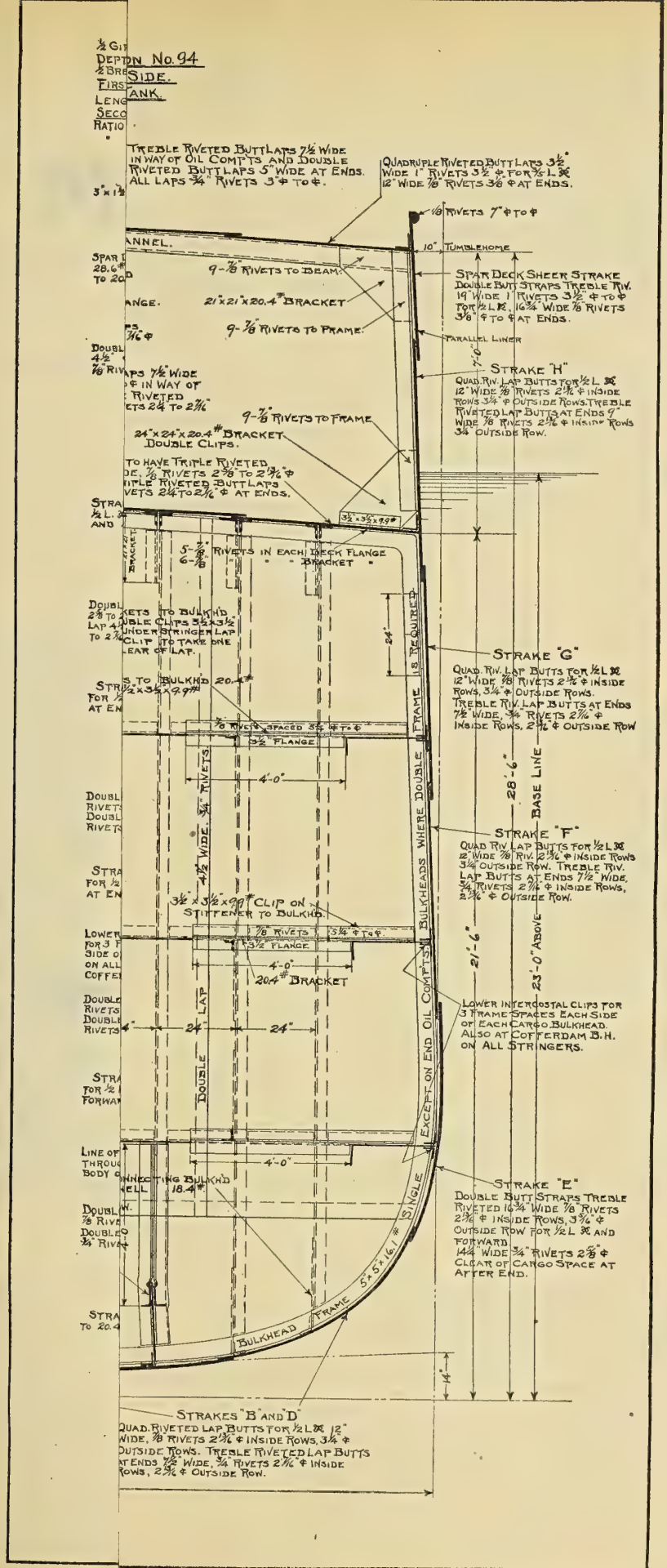
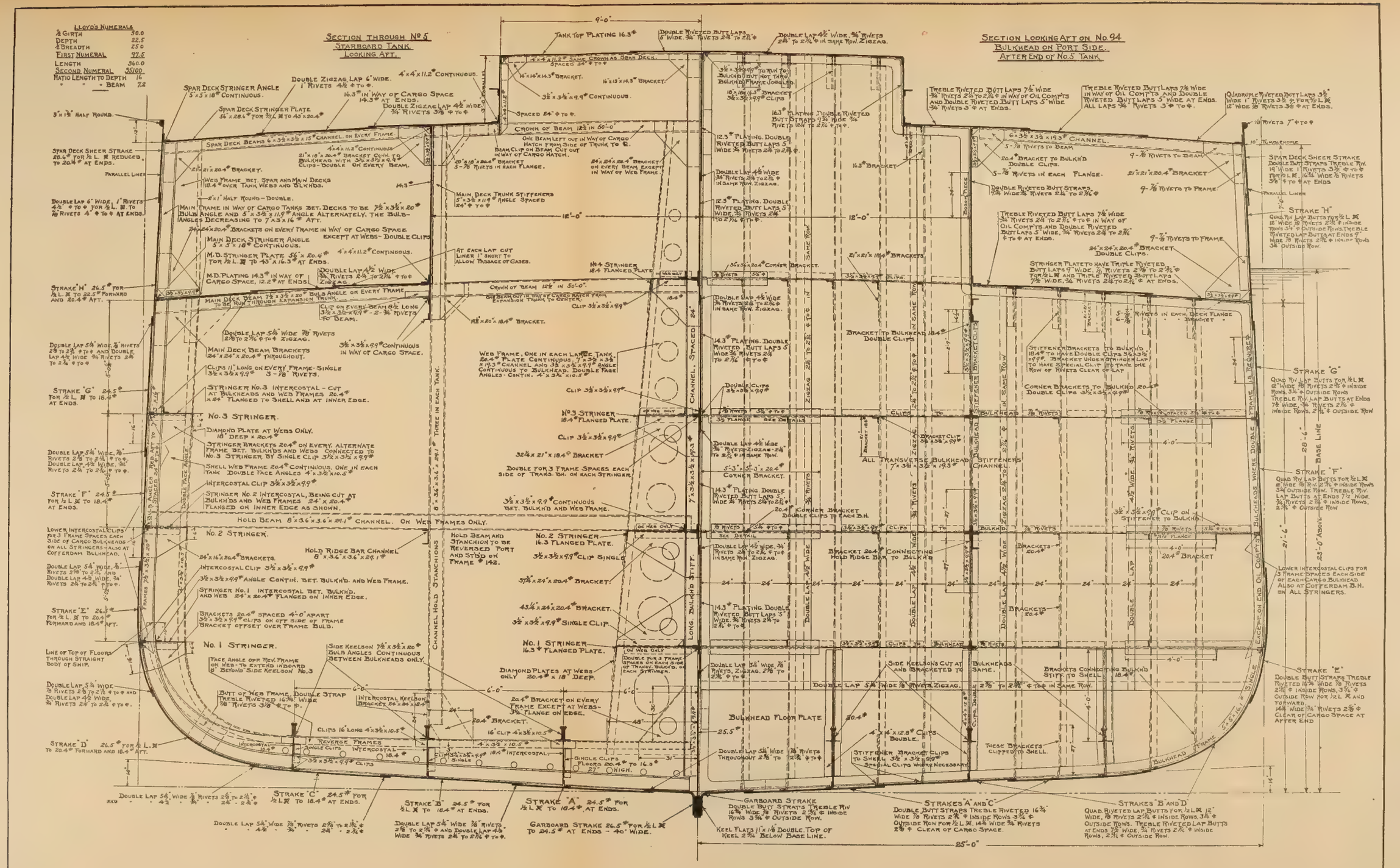

SECTION No. 94
SIDE.
TANK.
TREBLE RIVETED BUTT LAPS 7½ WIDE IN WAY OF OIL COMPTS AND DOUBLE RIVETED BUTT LAPS 5" WIDE AT ENDS. ALL LAPS ¾" RIVETS 3" ℄ TO ℄.
QUADRUPLE RIVETED BUTT LAPS 3½" WIDE 1" RIVETS 3½ ℄ FOR ½ L ℋ 12" WIDE ⅞" RIVETS 3⅜ ℄ AT ENDS.
⅞ RIVETS 7" ℄ TO ℄
10" TUMBLEHOME
9-⅞ RIVETS TO BEAM.
21"x21"x20.4# BRACKET
9-⅞ RIVETS TO FRAME.
SPAR DECK SHEER STRAKE
DOUBLE BUTT STRAPS TREBLE RIV. 19" WIDE 1" RIVETS 3½ ℄ TO ℄ FOR ½ L ℋ, 16¾ WIDE ⅞ RIVETS 3⅜" ℄ TO ℄ AT ENDS.
PARALLEL LINER
STRAKE "H"
QUAD. RIV. LAP BUTTS FOR ½ L ℋ 12" WIDE ⅞ RIVETS 2⅞ ℄ INSIDE ROWS 3¼ ℄ OUTSIDE ROWS. TREBLE RIVETED LAP BUTTS AT ENDS 9" WIDE ⅞ RIVETS 2⅞ ℄ INSIDE ROWS 3¼ OUTSIDE ROW.
9-⅞ RIVETS TO FRAME
24"x24"x20.4# BRACKET DOUBLE CLIPS.
32"x3½"x9.9#
5-⅞ RIVETS IN EACH DECK FLANGE
6-⅞ " " BRACKET
24"
STRAKE "G"
QUAD. RIV. LAP BUTTS FOR ½ L ℋ 12" WIDE ⅞ RIVETS 2⅞ ℄ INSIDE ROWS, 3¼ ℄ OUTSIDE ROWS. TREBLE RIV. LAP BUTTS AT ENDS 7½ WIDE, ¾ RIVETS 2⅞ ℄ INSIDE ROWS, 2⅞ ℄ OUTSIDE ROW
⅞ RIVETS SPACED 3½ ℄ TO ℄
3½" FLANGE
4'-0"
¾" RIVETS
4½" WIDE
28'-6" BASE LINE
STRAKE "F"
QUAD RIV LAP BUTTS FOR ½ L ℋ 12" WIDE ⅞ RIV 2¾ ℄ INSIDE ROWS 3¼ OUTSIDE ROW. TREBLE RIV. LAP BUTTS AT ENDS 7½ WIDE, ¾ RIVETS 2⅞ ℄ INSIDE ROWS, 2⅞ ℄ OUTSIDE ROW.
3½"x3½"x9.9# CLIP ON STIFFENER TO BULKHD.
⅞ RIVETS 3¼ ℄ TO ℄
3½" FLANGE
4'-0"
20.4# BRACKET
21'-6"
23'-0" ABOVE
LOWER INTERCOSTAL CLIPS FOR 3 FRAME SPACES EACH SIDE OF EACH CARGO BULKHEAD. ALSO AT COFFERDAM B.H. ON ALL STRINGERS.
24"
24"
DOUBLE LAP
4'-0"
CONNECTING BULKHD 18.4#
STRAKE "E"
DOUBLE BUTT STRAPS TREBLE RIVETED 16¾ WIDE ⅞ RIVETS 2⅞ ℄ INSIDE ROWS, 3⅜ ℄ OUTSIDE ROW FOR ½ L ℋ AND FORWARD 14¼ WIDE ¾ RIVETS 2⅝ ℄ CLEAR OF CARGO SPACE AT AFTER END.
5"x5"x16.1#
FRAME
BULKHEAD
14"
STRAKES "B" AND "D"
QUAD. RIVETED LAP BUTTS FOR ½ L ℋ 12" WIDE, ⅞ RIVETS 2⅞ ℄ INSIDE ROWS, 3¼ ℄ OUTSIDE ROWS. TREBLE RIVETED LAP BUTTS AT ENDS 7½ WIDE, ¾ RIVETS 2⅞ ℄ INSIDE ROWS, 2⅞ ℄ OUTSIDE ROW.
BULKHEADS WHERE DOUBLE FRAME IS REQUIRED
EXCEPT ON END OIL COMPTS
SINGLE

OMPANY.

Scale: 1-4 inch = 1 foot.

FOR DESCRIPTION SEE PAGE 356.


Lloyd's Numerals
Girth 30.0
Depth 22.5
Breadth 25.0
First Numeral 97.5
Length 360.0
Second Numeral 3600
Ratio Length to Depth 16
" " Beam 7.2
Section through No. 5 Starboard Tank. Looking Aft.
Section Looking Aft on No. 94 Bulkhead on Port Side. After End of No. 5 Tank.
Spar Deck Stringer Angle 5"x5"x18" Continuous.
Spar Deck Stringer Plate 56"x28.4" for 3/4 L.W to 43"x20.4"
Double Zigzag Lap 6" Wide. 1" Rivets 4 1/2" c to c.
16.3" in way of Cargo Space 14.3" at Ends.
Double Zigzag Lap 4 1/2" Wide. 3/4" Rivets 3 1/2" c to c
4"x4"x11.2" Continuous.
Tank Top Plating 16.3"
Double Riveted Butt Laps 6" Wide. 3/4" Rivets 2 1/4" to 2 1/2" c
Double Lap 4 1/2" Wide. 3/4" Rivets 2 1/4" to 2 1/2" c in same Row. Zigzag.
Crown of Beam 12 1/2" in 50'-0"
Spar Deck Beams 6"x3 1/2"x3 1/2"x15" Channel on every Frame.
Spar Deck Sheer Strake 28.6" for 1/2 L.W reduced to 20.4" at Ends.
Parallel Liner
Double Lap 6" Wide. 1" Rivets 4 1/2" c to c for 1/2 L.W to 7/8" Rivets 4" c to c at Ends.
Web Frame Bet. Spar and Main Decks 18.4" over Tank Webs and Bulkheads.
Main Frame in way of Cargo Tanks Bet. Decks to be 7 1/2"x3 1/2"x20" Bulb Angle and 5"x3 1/2"x11.9" Angle Alternately. The Bulb-Angles Decreasing to 7"x3"x16" Att.
24"x24"x20.4" Brackets on every Frame in way of Cargo Space except at Webs - Double Clips
Main Deck Stringer Angle 5"x5"x18" Continuous.
M.D. Stringer Plate 56"x20.4" for 1/2 L.W to 43"x16.3" at Ends.
M.D. Plating 14.3" in way of Cargo Space, 12.2" at Ends.
Double Lap 4 1/2" Wide 3/4" Rivets 2 1/4" to 2 1/2" c to c
4"x4"x11.2" Continuous.
At each Lap cut Liner 1" short to allow Passage of Gases.
No. 4 Stringer 18.4" Flanged Plate.
Strake "H" 26.5" for 1/2 L.W to 22.5" Forward and 20.4" Aft.
Main Deck Beam 7 1/2"x3 1/2"x20" Bulb Angle on every Frame to be Run through Expansion Trunk.
Clip on every Beam 8 1/2" long 3 1/2"x3 1/2"x9.9" - 2-3/4" Rivets to Beam.
Double Lap 5 1/2" Wide 7/8" Rivets 2 1/2" to 2 1/2" c to c Zigzag.
Main Deck Beam Brackets 24"x24"x20.4" throughout.
Double Lap 5 1/2" Wide 7/8" Rivets 2 1/2" to 2 1/2" c to c and Double Lap 4 1/2" Wide 3/4" Rivets 2 1/4" to 2 1/2" c to c
Clips 11" long on every Frame - Single 3 1/2"x3 1/2"x9.9" 3-7/8" Rivets.
Strake "G" 24.5" for 1/2 L.W to 18.4" at Ends.
Stringer No. 3 Intercostal - cut at Bulkheads and Web Frames 20.4"x24" Flanged to Shell and at Inner Edge.
No. 3 Stringer.
18" Deep x 20.4"
Diamond Plate at Webs Only.
Stringer Brackets 20.4" on every Alternate Frame Bet. Bulkheads and Webs connected to No. 3 Stringer by Single Clip 3 1/2"x3 1/2"x9.9"
Shell Web Frame 20.4" Continuous. One in each Tank. Double Face Angles 4"x3 1/2"x10.5"
Intercostal Clip 3 1/2"x3 1/2"x9.9"
Stringer No. 2 Intercostal, being cut at Bulkheads and Web Frames 24"x20.4" Flanged on Inner Edge as shown.
Strake "F" 24.5" for 1/2 L.W to 18.4" at Ends.
Hold Beam 8"x3.6"x3.6"x21.1" Channel. On Web Frames Only.
Lower Intercostal Clips for 3 Frame Spaces each Side of Cargo Bulkheads on all Stringers - Also at Cofferdam Bulkhead.
No. 2 Stringer.
Hold Ridge Bar Channel 8"x3.6"x3.6"x21.1"
24"x16"x20.4" Brackets.
Double Lap 5 1/2" Wide 7/8" Rivets 2 1/2" to 2 1/2" and Double Lap 4 1/2" Wide 3/4" Rivets 2 1/4" to 2 1/2" c to c.
Intercostal Clip 3 1/2"x3 1/2"x9.9"
3 1/2"x3 1/2"x9.9" Angle Contin. Bet. Bulkh'd. and Web Frame.
Stringer No. 1 Intercostal Bet. Bulkh'd. and Web 24"x20.4" Flanged on Inner Edge.
Strake "E" 26.5" for 1/2 L.W to 20.4" Forward and 18.4" Aft.
Brackets 20.4" spaced 4'-0" apart 3 1/2"x3 1/2"x9.9" Clips on off side of Frame Bracket offset over Frame Bulb.
Hold Beam and Stanchion to be Reversed Port and Stbd on Frame # 142.
No. 2 Stringer 16.3" Flanged Plate.
3 1/2"x3 1/2"x9.9" Clip Single.
37 1/2"x24"x20.4" Bracket.
43 1/2"x24"x20.4" Bracket.
3 1/2"x3 1/2"x9.9" Single Clip.
No. 1 Stringer.
Line of Top of Floors through Straight Body of Ship.
Face Angle opp. Rev. Frame on Web - to extend inboard 8" beyond Side Keelson No. 3
Side Keelson 7/8"x3 1/2"x20" Bulb Angles Continuous between Bulkheads only.
No. 1 Stringer 16.3" Flanged Plate.
Diamond Plates at Webs only 20.4"x18" Deep.
Double Lap 5 1/2" Wide 7/8" Rivets 2 1/2" to 2 1/2" c to c and Double Lap 4 1/2" Wide 3/4" Rivets 2 1/2" to 2 1/2" c to c.
Butt of Web Frame. Double Strap Treble Riveted 16 3/4" Wide 7/8" Rivets 3/8" c to c.
Intercostal Keelson Bracket 24"x24"x18.4"
20.4" Bracket on every Frame except at Webs - 3/8" Flange on Edge.
20.4" Bracket.
16" Clip 4"x3 1/2"x10.5"
Clips 16" long 4"x3 1/2"x10.5"
Reverse Frames Angle Clips
Intercostal 18.4"
4"x3 1/2"x10.5"
3" Clips 3"x3"x9.9" Single
18.4" Intercostal.
Single Clips Floors 20.4" to 16.3" High.
3 1/2"x3 1/2"x9.9" Clips
Strake "D" 26.5" for 1/2 L.W to 20.4" Forward and 18.4" Aft.
Double Lap 5 1/2" Wide 7/8" Rivets 2 1/2" to 2 1/2" c
Strake "C" 24.5" for 1/2 L.W to 18.4" at Ends.
Strake "B" 24.5" for 1/2 L.W to 18.4" at Ends.
Strake "A" 24.5" for 1/2 L.W to 18.4" at Ends.
Garboard Strake 26.5" for 1/2 L.W to 24.5" at Ends - 40" wide.
Keel Flats 1"x 1/8" Double. Top of Keel 2 3/4" below Base Line.
Garboard Strake Double Butt Straps Treble Riv 16 3/4" Wide 7/8" Rivets 2 3/4" c Inside Rows 3 3/4" c Outside Row.
Strakes "A" and "C" Double Butt Straps Treble Riveted 16 3/4" Wide 7/8" Rivets 2 3/4" c Inside Rows 3 3/4" c Outside Row for 1/2 L.W. 14 3/4" Wide 3/4" Rivets 2 3/4" c Clear of Cargo Space.
Strakes "B" and "D" Quad. Riveted Lap Butts for 1/2 L.W 12" Wide, 7/8" Rivets 2 3/4" c Inside Rows, 3 1/4" c Outside Rows. Treble Riveted Lap Butts at Ends 7/8" Wide 3/4" Rivets 2 3/4" c Inside Rows, 2 3/4" c Outside Row.
Treble Riveted Butt Laps 7 1/2" Wide 3/4" Rivets 2 1/4" to 2 3/4" c to c in way of Oil Compt's and Double Riveted Butt Laps 5" Wide. 3/4" Rivets 3" c to c at Ends.
Treble Riveted Butt Laps 7 1/2" Wide 3/4" Rivets 2 1/4" to 2 3/4" c to c in way of Oil Compt's and Double Riveted Butt Laps 5" Wide. 3/4" Rivets 2 1/4" to 2 3/4" c to c at Ends.
Quadruple Riveted Butt Laps 3 1/2" Wide 1" Rivets 3 1/2" c for 1/2 L.W 12" Wide 7/8" Rivets 3.6" at Ends.
16" Rivets 7" c to c
10" Tumblehome
Spar Deck Sheer Strake Double Butt Straps Treble Riv. 14" Wide 1" Rivets 3 1/2" c to c for 1/2 L.W. 16 3/4" Wide 7/8" Rivets 3 1/2" c to c at Ends
Parallel Liner
Strake "H" Quad. Riv. Lap Butts for 1/2 L.W 12" Wide 7/8" Rivets 2 3/4" c Inside Rows 3 1/4" c Outside Rows Treble Riveted Lap Butt at Ends 7/8" Wide 7/8" Rivets 2 3/4" c Inside Rows 3 1/4" c Outside Row.
6"x3 1/2"x19.3" Channel.
5-7/8" Rivets to Beam.
20.4" Bracket to Bulkh'd Double Clips.
5-7/8" Rivets in each Flange.
Double Riveted Butt Straps 7/8" Wide 3/4" Rivets 2 1/4" to 2 3/4" c
9-7/8" Rivets to Beam.
21"x21"x20.4" Bracket
9-7/8" Rivets to Frame
24"x24"x20.4" Bracket. Double Clips.
Stringer Plate to have Triple Riveted Butt Laps 9" Wide. 7/8" Rivets 2 3/4" to 2 3/4" c for 1/2 L.W and Triple Riveted Butt Laps 7 1/2" Wide. 3/4" Rivets 2 1/4" to 2 3/4" c at Ends.
Strake "G" Quad Riv Lap Butts for 1/2 L.W 12" Wide 7/8" Rivets 2 3/4" c Inside Rows. 3 1/4" c Outside Rows Treble Riv Lap Butts at Ends 7 1/2" Wide. 3/4" Rivets 2 3/4" c Inside Rows. 2 3/4" c Outside Row
Strake "F" Quad Riv Lap Butts for 1/2 L.W 12" Wide 7/8" Rivs 2 3/4" c Inside Rows 3 1/4" c Outside Row. Treble Riv Lap Butts at Ends 7 1/2" Wide. 3/4" Rivets 2 3/4" c Inside Rows. 2 3/4" c Outside Row
Strake "E" Double Butt Straps Treble Riveted 16 3/4" Wide 7/8" Rivets 2 3/4" c Inside Rows. 3 1/4" c Outside Row for 1/2 L.W and forward. 14 3/4" Wide 3/4" Rivets 2 3/4" c Clear of Cargo Space at After End
Lower Intercostal Clips for 3 Frame Spaces each Side of each Cargo Bulkhead. Also at Cofferdam B.H. on all Stringers.
Base Line
23'-0" above
28'-6"
21'-6"
12'-0"
25'-0"
Bulkhead Stiff.
Channel Hold Stanchions
Long. Bulkhd Stiff.
Channel Spaced 24" c to c
Double Face Angles
Bulkhead Floor Plate
Bulkhead Floor Plate 30.4"
Double Lap 5 1/2" Wide 7/8" Rivets Zigzag. 2 3/4" to 2 3/4" c to c in same Row.
Side Keelsons Cut and Bracketed to Bulkheads Same.
Brackets Connecting Bulkhd Stiff. to Shell.
Stiffener Bracket Clips to Shell 3/8"x3 1/2"x9.9" Special Clips where necessary.
These Brackets Clipped to Shell.
4"x4"x12.8" Clips Double.
Bracket 20.4" Connecting Hold Ridge Bar to Bulkh'd
Stiffeners Channel.
All Transverse Bulkhead 7"x3 1/2"x3 1/2"x19.3"
Bracket Clip 3 1/2"x3 1/2"x9.9"
Corner Brackets to Bulkh'd 20.4" Double Clips 3 1/2"x3 1/2"x9.9"
Stiffener Brackets to Bulkh'd 18.4" to have Double Clips 3 1/2"x3 1/2"x9.9" Bracket under Stringer Lap to have Special Clip to take one Row of Rivets Clear of Lap
Brackets 20.4"
20.4" Bracket
Clips to Bulkhead
Bracket Clip 3 1/2"x3 1/2"x9.9"
Clip on Stiffener to Bulkhd.
Double Lap 4 1/2" Wide 3/4" Rivets Zigzag 2 1/4" to 2 1/2" c in same Row.
Double for 3 Frame Spaces each side of Trans. Bh. on each Stringer.
Double Clips 3 1/2"x3 1/2"x9.9"
Bracket Clip 18.4"
Bracket Tp Bulkhead 18.4" Double Clips
Corner Bracket 20.4" Double Clips to each B.H.
Corner Bracket 5'-3"x5'-3"x20.4"
Clip 3 1/2"x3 1/2"x9.9"
Double Clips 3 1/2"x3 1/2"x9.9"
Web Frame. One in each Large Tank. 20.4" Plate Continuous. 7"x3 1/2"x3 1/2"x19.3" Channel and 3 1/2"x3 1/2"x9.9" Angle Continuous to Bulkhead. Double Face Angles - Contin. 4"x3 1/2"x10.5"
32 1/4"x21"x18.4" Bracket
No. 3 Stringer 18.4" Flanged Plate.
3 1/2"x3 1/2"x9.9" Continuous Bet. Bulkh'd and Web Frame.
3 1/2"x3 1/2"x9.9" Continuous in way of Cargo Space.
18"x20"x18.4" Bracket
Clip 3 1/2"x3 1/2"x9.9"
Crown of Beam 12 1/2" in 50'-0"
One Beam out in way of Cargo Hatch from Expansion Trunk to Centre.
Double Lap 4 1/2" Wide 3/4" Rivets 2 1/4" to 2 1/2" c in same Row. Zigzag.
14.3" Plating. Double Riveted Butt Laps 5" Wide 3/4" Rivets 2 1/4" to 2 1/2" c to c
Double Lap 4 1/2" Wide 3/4" Rivets 2 1/4" to 2 1/2" c in same Row. Zigzag.
21"x21"x18.4" Brackets
36"x36"x20.4" Corner Bracket.
Double Riveted Butt Laps 5" Wide. 3/4" Rivets 2 1/4" to 2 1/2" c
12.3" Plating. Double Riveted Butt Laps 5" Wide. 3/4" Rivets 2 1/4" to 2 1/2" c
Double Lap 4 1/2" Wide 3/4" Rivets 2 1/4" to 2 1/2" c in same Row. Zigzag.
16.3" Plating Double Riveted Butt Straps 7 1/2" Wide 3/4" Rivets 2 1/4" to 2 1/2" c
16.3" Bracket
3 1/2"x3 1/2"x9.9" to run to Bulkhd but not thro Bulkhd. Frame Joggled Lap
18"x18"x16.3" Bracket
3 1/2"x3 1/2"x9.9" Clips
Crown of Beam 12 1/2" in 50'-0"
One Beam left out in way of Cargo Hatch from side of Trunk to C.
Beam Clip on Beam Cut out in way of Cargo Hatch.
20"x18"x20.4" Bracket 5-7/8" Rivets in each Flange.
84"x24"x20.4" Bracket on every Beam except in way of Web Frame.
Main Deck Trunk Stiffeners 5"x3 1/2"x11.9" Angle Spaced 24" c to c
12'-0"
4"x4"x11.2" Continuous
21"x18"x20.4" Bracket Contin. to Bulkhead with 3 1/2"x3 1/2"x9.9" Clips - Double on every Beam.
8"x1" Half Round - Double.
Double Lap 5 1/2" Wide 7/8" Rivets 2 1/2" to 2 1/2" c to c Zigzag.
Double Lap 5 1/2" Wide 7/8" Rivets 2 1/2" to 2 1/2" c to c and Double Lap 4 1/2" Wide 3/4" Rivets 2 1/4" to 2 1/2" c to c
Strake "H" 26.5" for 1/2 L.W to 22.5" Forward and 20.4" Aft.
Double Lap 5 1/2" Wide 7/8" Rivets 2 1/2" to 2 1/2" c
Strake "C" 24.5" for 1/2 L.W to 18.4" at Ends.
Strake "B" 24.5" for 1/2 L.W to 18.4" at Ends.
Strake "A" 24.5" for 1/2 L.W to 18.4" at Ends.
Garboard Strake 26.5" for 1/2 L.W to 24.5" at Ends - 40" wide.
Double Lap 5 1/2" Wide 7/8" Rivets 2 1/2" to 2 1/2" c and Double Lap 4 1/2" Wide 3/4" Rivets 2 1/4" to 2 1/2" c to c.

MIDSHIP SECTION OF OIL BARGES NOS. 94 AND 95, OF THE STANDARD OIL COMPANY, BUILT BY THE TOWNSEND-DOWNEY SHIPBUILDING COMPANY.

Scale: 1-4 inch = 1 foot.

FOR DESCRIPTION SEE PAGE 356.

officers' deck house, with an entrance to the first cabin staterooms below. On the forward side of this house are mounted two cargo booms. The main mast is stepped directly aft of this house with hatch in the wake. Two winches for handling the cargo for this hatch are placed on this deck house and two boats are swung on the upper deck. Next comes the main deck house, from which rise the two funnels. A flying bridge leads from the wheel house and navigation bridge to the top of this structure.

On the boat deck eight life boats are swung on ordinary davits. Cargo hatch No. 5 is between the main superstructure and the house built for the second cabin passengers. On top of house are two winches, two boats, and eight collapsible boats, and through it rises the mizzen mast, fitted with three cargo booms. Following in order come two winches, cargo hatch No. 6, with a winch and four boats mounted on the top of a flying bridge, hatch No. 7, two more winches, the spanker mast and two cargo winches, a winch with two extended gypsy heads, two Napier warping capstans, and the steering engine mounted in a steel house.

The hatches for the passengers and crew are not included in the above summary. The steering engine is of the Wilson & Pirrie type, and consists of two sets of double engines mounted on sliding bases and driving through reduction and spur gears the rudder quadrant. One of these double engines is held in reserve in case the other one should give out, when the base may be quickly shifted and the gearing engaged and the disabled engine likewise disengaged. One valve controls the steam for both the cylinders, and is of the usual type.

With these points in mind, a brief description of the general arrangement of the decks will serve to convey an approximate idea of this immense vessel.

First-class passenger accommodations are provided amidships, on the upper and shelter decks, and in the midship superstructure. The forward part of the top deck is thrown open to the passengers, forming one of the finest large sun decks imaginable. The ship's compass is mounted high above the saloon skylight. Descending to the upper promenade or boat deck a beautiful large library extends across the forward end of the the house. This library opens from a lobby with skylight above and stairway descending to all decks of the first-cabin passenger accommodations. A handsome smoking room is entered from a passage on the port side, which is well lighted through white and gold crystal windows and skylight. The arrangement and general effect of this room are shown in the illustration on page 351. On the deck below, or the promenade deck, are placed many of the state rooms, entered from passage ways fore and aft on each side of the ship. Cross passages lead to bath and toilet rooms, which are equipped with the latest and most approved heavy porcelain ware. Many of the state rooms are arranged ensuite with bath room and sitting room connecting. The floors of the lobby on all decks are laid with large squares of white rubber tiling and the passage ways with interlocking tiling. The finish of the lobbies is polished oak and of the passage ways white enamel. The state rooms are of white enamel and mahogany furnishing. In each room are two berths with upper one arranged to fold up, a broad settee, a folding combined lavatory and desk, and a clothes press. Electric lights and call bells are provided and each room is heated by an independent electric heater. The arrangement of accommodations on the spar deck is practically the same as on the promenade deck. Mention should be made of the unobstructed broad promenade space on each of these three decks. Again descending, the passenger arrives on the main saloon deck. The landing is a glass-enclosed lobby opening into the main dining saloon which extends from side to side of the ship and is provided with tables for seating 370 people. The design of this room has been carefully chosen to present a light and airy appearance. The ceiling is in white panels set up with gold. The saloon is well lighted in day time by the side lights and a large crystal central dome with white and gold leaded glass. Panels surrounding the dome are painted with views of American and English landscapes. Numerous individual electric lights are distributed over the ceiling panels, and behind the crystal dome for illuminating at night time. Ventilation is secured by exhaust air ducts connected with the sky light and by trunk ventilators placed in the ceiling on line with the deck house above. The revolving chairs are of mahogany with tapestried seats; the floor is laid in light wood. The remaining first-class state rooms are forward of the dining saloon and on the starboard side aft of the saloon. The pantry adjoints the dining saloon on the port side, and aft of it is the galley for first and second cabins.

The second-class dining saloon is on the starboard side aft of the first-cabin accommodations. The equipment and furnishings of this saloon, as well as of the state rooms, are but slightly inferior to those of the first cabin. The second-class state rooms are reached by descending to the deck below, *i.e.*, main deck. The entrance to the second cabin is from a deck house in which are the smoking room and library, each very comfortably furnished, the latter shown on page 353.

In arranging for passenger accommodations, the company has not slighted the third cabin or steerage; in fact, it is the accommodations for this class of passengers that the *Baltic* presents unique features. The White Star line has always made a point of equipping the third cabin in better than the ordinary style. Dining saloons, fitted with long tables and revolving chairs (the meals are served by regular stewards), state rooms with two, three and four berths, and ample toilet rooms, make up the third-class accommodations. Ventilation is provided the second and third cabins by means of large steel air ducts placed overhead in the passages directly below the deck beams, carrying fresh air to all parts. Ample promenade space is allotted for the passengers of these classes. The first cabin has accommodations for a maximum of 425, the second cabin 250, third cabin from 1,270 to 2,000, and the crew numbers 350.

MAIN ENGINES.

The *Baltic* is fitted with two sets of four-cylinder, quadruple-expansion engines of about 7,000 horse power each, of the usual type turned out by the builders for vessels of this class, and practically identical to the engines of the *Cedric* and *Celtic*. The engine room is very roomy and extends the full width of the ship, with recess in after bulkhead for thrust bearings, and on

VIEWS OF THE FIRST-CABIN ACCOMMODATIONS ON THE NEW TWIN-SCREW STEAMSHIP BALTIC.

Smoking Room
Boat Deck, Looking Forward.

Dining Saloon
Library.

lower deck with recess for electric-light plant. A Howden centrifugal fan is placed on forward and after engine room hatch casing for ventilating the engine room. The arrangement of the cylinders and valves of main engines is as follows: h. p. piston valve, high-pressure cylinder, second intermediate cylinder, two 2d i. p. piston valves, l. p. slide valve, low-pressure cylinder, first intermediate cylinder, 1st i. p. piston valve. The diameters of the cylinders are 33, 47 1-2, 68 1-2, 98, and the stroke is 63 inches. The working pressure is 210 pounds. The end cylinders are cast with their respecting valves, while the valves of the middle cylinders are in separate castings and bolted in place. The cylinders are mounted on eight cast-iron housings of box section, the housings being tied at the top front and back by heavy horizontal cast-iron girders. The condenser is built in the framing of the low and first intermediate-pressure cylinders, and the air pump is driven by levers from the first intermediate cross head. Each cylinder is free to expand separately and yet the construction of columns forms a very rigid support. The bed plate is of cast-iron box section and in four parts. The valves are operated by Stephenson double-link motion with double cylinder reversing engine mounted on the front second intermediate column. The double ported slide valve of the low-pressure is fitted with a balanced piston.

The main pistons are conical and of cast iron. Ramsbottom packing rings are used. Tail rods are fitted on the second intermediate and low-pressure pistons. Piston rods are forged steel 9 3-8 inches diameter, and the cross heads are malleable steel fitted with cast-iron adjustable shoes lined with white metal. The connecting rods have forked upper ends, and are of mild forged steel 11 feet 10 inches between centers, 9 1-4 inches diameter at top, and 10 1-2 inches at bottom. The boxes at top and bottom are of phosphor bronze. The crosshead guides on both front and back columns are of cast iron with hollow backs for water circulation, and are removable and adjustable. The crank shaft is of the built-up type, in four sections, 19 1-4 inches in diameter with a 2 1-2-inch bored hole. The pins are 19 1-2 inches long and 20 inches diameter. All is of mild steel, which material is used for the rest of the shaft. The turning engine is placed on the condenser opposite the center coupling of the crank shaft and is driven by double engine and worm gear. The arrangement of cranks is on the Yarrow, Schlick, Tweedy system and the sequence is as follows: high-pressure, 1st intermediate, 2d intermediate, low-pressure. The thrust shaft is 18 3-4 inches diameter with ten colors. The horse-shoe bearings are cored out for salt-water circulation and are lined with white metal.

The line shaft is in 8 sections 18 3-4 inches diameter and the propeller shaft is 19 5-8 inches diameter. The stern tube is of cast iron. The main journals of the crank shaft are eight in number, the end ones being 26 inches long and the remaining six 24 inches long. Steady bearings are at either end of the thrust block and in the shaft alleys there are 15 bearings. The engine is equipped with complete water and oil service. The columns of the main engine are used as oil reservoirs. An Aspinwall governor is fitted on the high-pressure cross head of each engine.

Each main condenser contains 2,153 copper tinned tubes arranged in two nests. The cooling surface of each is about 9,000 square feet. Two bilge and two sanitary pumps are driven from the air-pump cross head. Steam for all auxiliaries, except the feed pumps, is reduced to 100 pounds pressure.

AUXILIARIES.

The auxiliaries are in duplicate throughout, each engine being entirely independent of the other. Following are given the total number of both engines:

2 circulating centrifugal pumps, driven by single engine.
5 Weir feed pumps.
3 Westminster ballast pumps.
1 Quiggins' feed-water heater.
1 Quiggins' evaporator.
2 Railton & Campbell's grease extractors.
3 ballast pumps.
7 duplex pumps for various ship uses.
1 ash-ejector pump.

A large refrigerating plant is located amidships forward of the boiler rooms and consists of a triple-expansion, two-crank engine, driving two carbonic anhydride compressors built by the J. E. Hall Company. The engine is of the horizontal type, the high and intermediate cylinders being tandem with one of the compressors and the low-pressure cylinder tandem to the

Marine Engineering Data Card. **August 1, 1904.**

Name—Baltic. Nationality—British. Type—Ocean passenger and freight.
Launched—1903. Builder—Harland and Wolff. Owner—White Star Line.

Length over all.....726 ft. 0 ins.
Breadth, molded.....75 " 0 "
Depth.....49 " 0 "
Registered tons, about.....24,000 tons
Cargo capacity, " .....28,000 "
Displacement, " .....40,000 "
Engines.....two; four-cylinder, quadruple
Cylinder diams.....33, 47 1-2, 68 1-2, 98 ins.
Stroke.....63 "
Valves.....piston, except L. P. slide
R. P. M., sea 78
I. H. P.....14,000
Speed.....17 knots
Condensers (2), cool. surf.....18,000 sq. ft.
Shafting diam., crank, 19 1-4 ins.; pins, 20 ins.
" thrust and line, 18 3-4 ins.
" " propeller., 19 5-8 "
Piston rods, diam.....9 3 8 "

Connecting rods, diam., 9 1-4 ins top, 10 1-2 ins. bottom
" rods, dis. bet. centers, 11 ft, 10 ins.
Propellers.....two, three blades
Pitch.....24 ft. 6 ins.
Diameter.....20 " 0 "
Area.....99 sq. ft.
Boilers.....eight double-end Scotch
Pressure.....210 lbs.
Diameter.....15 ft. 6 ins.
Length .....19 " 6 "
Plates.....1 19-32
Tubes.....852 each, 2 5-8 ins. o. d.
" length.....7 ft. 10 ins.
Furnaces: No. each boiler.....6
Diam., outside.....48 3-8 ins.
G. S., total.....1,008 sq. "
H. S., " .....41,680 " "
Draft.....natural

second compressor. In the engine base is condenser, and direct connected to shaft are air and circulating pumps. The two carbonic anhydride condensers are the same compartment for ship stores purposes, equal to 7 1-2 tons per 24 hours.

The electric-lighting plant is placed in a recess at the

SECOND-CABIN SMOKING ROOM, TWIN-SCREW STEAMSHIP BALTIC.

ONE OF THE DINING ROOMS OF THE THIRD CABIN, TWIN-SCREW STEAMSHIP BALTIC.

separate. The capacity of this plant, which is used for chill rooms in the cargo space, is 54 tons of ice per day. Another smaller Hall refrigerating plant is mounted in after end of engine room, and comprises four direct-connected sets made by W. H. Allen, Son & Company. The engines are two-crank compound, 12 and 20 inches

by 12 inches stroke, with piston valve, and run at 230 revolutions. Six-pole generators are wound for 102 volts and 750 amperes. The sets are connected for parallel running and the wiring is of the two-wire system, while the third wire connecting the machines acts as an equalizer. For grinding the commutators in place, a motor-driven grinder may be attached to each machine. The engines are very compact and strongly built with cast-iron housings at the back and two wrought-iron columns at the front. Solid cross heads are fitted with tapered-driven pins. The connecting rods have forked upper ends and phosphor-bronze boxes at bottom. The pistons are cast iron and flat fitted with double spring rings. Regulation is secured through an inertia governor operating a throttle valve. Three sets ordinarily carry the full load for light and power purposes. There are in all 14 electric motors on board, ten of which are used for driving Sirocco ventilating fans and the remainder in the galley for turning the roasting spickets, dough mixers, etc. Electricity is also used for heating in the first-cabin saloons and state rooms.

BOILERS.

The boilers are placed in two stoke holds and are eight in number, of the double-end Scotch type. There are four boilers in each hold with a large coal bunker between. There is a shallow coal bunker in the forward engine-room bulkhead serving as chute for the coal from bunkers overhead, and a large cross bunker is forward of the boiler room. Each boiler has three furnaces at each end, thus making 48 furnaces in all. Dampers are placed in each smoke box, six to a boiler. Natural draft is used, but in order to carry the air down to the fire room large fans are placed at the top of the fidley grating and drive the air down through chutes on the bunker bulkheads to points about opposite the furnaces. Hydraulic ash ejectors are fitted for removing the ashes. A pipe alley runs from boiler room forward in which are laid various steam and ballast pipes. This also serves as a passage for firemen to their quarters forward.

The boilers are 19 feet 6 inches long and 15 feet 6 inches diameter. The total grate surface is 1,008 square feet, and the heating surface 41,680 square feet.

In each boiler there are 857 tubes, 2 5-8 inches outside diameter by 7 feet 10 inches between sheets; the corrugated furnaces are 48 3-8 inches greatest diameter; the boiler shell is made of 1 19-32-inch plate.

The propellers have three bronze blades; the pitch is 24 feet 6 inches and the diameter 20 feet.

With the addition of the *Baltic*, the White Star line's fleet now consists of thirty-one ocean steamers, with an aggregate tonnage of 360,000 tons. Of these 27 are fitted with twin screws, while 21 are each for 10,000. It is to be hoped that the *Baltic* will be no exception to the list of successful ships operated by this company.

OBITUARY.

It will be learned with regret that Thomas Rowland Western, cashier of the Manufacturers' Advertising Bureau, New York, of which Benjamin R. Western, his father, is the proprietor, died suddenly on May 22, after an illness of only a few days. Mr. Western was of a genial and accommodating disposition and will be missed by many admiring friends.

Practical Points for a Marine Engineer.

BY E. M. PERCY.

Few of the younger engineers of to-day are satisfied with merely a little knowledge of safety valves and stay bolts, sufficient to pass their examinations. There are many things they wish to know, but cannot tell where to find them; not a long, tedious education, but merely some of the practical facts of experience, in figures. For instance, how large should a pipe be? or how many feet of cooling surface should a condenser have?

Not even a handbook is needed, as the more important of these can be given, as here, in a short article.

Beginning with boilers, of the Scotch type, we find the heating surface with natural draft is from 28 to 35 times the grate surface, and from 35 to 48 times for assisted draft, while in water-tube boilers the ratio is higher—in torpedo boats as great as 60 times the grate surface. The heating surface varies in different designs from 2 to 3 square feet per I. H. P., and the I. H. P. per square foot of grate surface varies from 10 in merchant ships to 30 in torpedo boats. The cross-sectional area of stacks and uptakes vary through wide ranges, but without forced or induced draft their area will average one-eighth of the grate surface if correctly proportioned. The amount of water evaporated per hour per I. H. P. for main engines varies from 12 or 14 pounds to 20. For auxiliaries it may run to absurdly wasteful amounts, such as 80 pounds. The coal burned per horse power per hour on an average ship varies from 1 1-2 to 4 pounds per horse power per hour. At 212 degrees Fahrenheit, with clean boiler, as in a test, one pound of coal will evaporate from 9 to 14 pounds of water.

Engineers should particularly note the difference between *stages* of expansions, such as compound, triple, quadruple, etc., and *number* of expansions, which varies from 10 to 20 or more. To get the *number* of expansions take volume of the high-pressure cylinder up to point of cut off and divide it into the total volume of the low-pressure cylinder; the quotient will be the number of expansions. The intermediate cylinders are disregarded, as they are only intermediate expansions.

The area of the ports is calculated from the displacement of the piston times the number of strokes per minute. That is this volume of exhaust steam must be removed through the ports every minute, and the ports are so proportioned that the steam shall attain no higher velocity than 4,000 or 5,000 feet a minute. This gives the ratio: piston speed is to 5,000 as area of cylinder is to X (or area of port). If the ports are properly proportioned for exhaust steam, there will be plenty of area for live steam, which is allowed a velocity of 7,000 to 10,000 feet a minute, depending upon its pressure. This is why the steam ports are never wholly uncovered by the outside lap. The area of the steam pipe is figured in the same way, except that the steam should travel slower than in the ports.

The science of distribution of steam can be best understood by studying a good work on combined cards, such as Holmes or Auchincloss. The cards are taken from the cylinders and then combined on one drawing all to the same scale of volumes and pressures, due allowance being taken of cylinder clearance volumes. This com-

bined diagram then becomes the most valuable of any method for securing proper steam distribution.

One thing that every marine engineer ought to thoroughly familiarize himself with is the table of properties of saturated steam. Here are found at all pressures up to 300 pounds per square inch, the boiling points, latent heat, sensible heat, total heat, volume per pound, weight per cubic foot, and other useful data. If one has the size of a steam pipe and number of expansions he has but to look in his steam tables to get the approximate size of the exhaust pipe, since he has the ratios of volumes, and we know that pressure varies inversely as expansion.

Condensers have from 1 1-4 to 2 square feet of cooling surface per I. H. P. The amount of circulating water and size of pipes necessary is calculated from the latent heat of the steam and the speed of the water through the tubes. The area of the average sea injection and overboard discharge may be placed at an average of one-fourth the total area of the passage through the tubes. The size of the air pump can only be arrived at by complicated calculation, but it averages one-fourth the volumetric displacement of the low-pressure cylinder.

Pumps are chosen with regard to the amount of water they will handle easily. Their piston speed should never exceed 200 feet per minute, and the speed of water through pipes should be less than 500 feet per minute.

Electrical units bother engineers, too. Volts are the measure of the pressure, amperes the measure of quantity. Volts times amperes equals watts; 1,000 watts are termed a kilo watt; 746 watts make a mechanical horse power. On an average there are seven 16-candle-power lamps to a horse power.

For refrigerating machinery we have tables of the properties of saturated ammonia gas, and an engineer cannot do better than study these carefully. Also of carbonic-acid gas, of pictet fluid, and of ether. From the table we get the latent heat of vaporization which is the fundamental principle of refrigeration in any form. Also, it is well to know that for every pound of ice made 142 British thermal units (B. T. U.) of latent heat are given up, for which there is no lowering of temperature, and for every pound of steam made about 1,000 British thermal units of heat are taken up latently, for which there is no rise in temperature. A British thermal unit is the amount of heat required to raise the temperature of one pound of water from 62 to 63 degrees Fahrenheit. A pound of coal when burned gives out 12,000 to 15,000 British thermal units.

Evaporators depend entirely for their principle of operation upon the latent heat of the steam being transmitted to the salt water, to become the latent and sensible heat of its vapor. An evaporator may or may not waste a great deal of heat, according to how it is operated.*

Careful and painstaking engineers are often seen to do ridiculous things because of lack of knowledge on some technical point. Once a chief engineer ordered the electrician to leave the rheostat off and regulate the engine with the throttle, because it took the load off the armature. This is like hanging the weight farther down on the rope because the top was weak.

*See Marine Engineering, July, 1903, p. 258, for article on "Evaporation," by Mr. Percy.

Another man would slow down his brine pump in hot weather, so that the refrigerating machine could get it colder. He overlooked the fact that it was the rooms, not the brine, that needed cooling. Another engineer would close the auxiliary stop valve until barely cracked, and then, in the face of slowed-down machinery, etc., maintain that the trouble was elsewhere.

Another engineer took out the baffle plate of an already overloaded condenser "so the steam could get around quicker."

Another man carefully lagged the hot pipes from the ammonia compressor to the ammonia condenser "to save the heat," which the next instant was thrown away by the condenser. Another built a drinking-water can around the air chamber of his refrigerating brine pump and then stuffed the space between the pump chamber and the can with asbestos.

These things, while showing industry and ambition, show an ignorance of the common principles of thermodynamics.

Battleship Kentucky's Record Run.

The United States battleship *Kentucky,* with Rear-Admiral Robley D. Evans, recently arrived in New York after three years and seven months in eastern waters, completing a most remarkable cruise. She steamed in all 68,000 miles, and on her homeward voyage from Hongkong she made 12,916 miles, including the slow passage through the Suez canal, in 39 steaming days, or an average of 12.7 knots. This is a record that has not been approached by any other ship of any navy. On her voyage from Southampton to New York the *Kentucky* averaged 13.82 knots, running under natural draft. The *Kearsarge,* a sister ship, and holder of the previous battleship record, made the run a year ago at an average of 13.50 knots, under similar conditions. The *Kentucky* also broke the world's record for rapid and accurate gun firing with her 13- and 8-inch guns, and established a new standard with her 6-inch battery. The ship was everywhere received with great enthusiasm which culminated in the reception at Naples, where, accompanied with the French and Italian squadrons, she took part in the ceremonies attending the visit of president Loubet of France. Later the King of Italy dined on board with the admiral.

Customs in the Panama Canal Zone.—The custom duties of the United States tariff are to be extended to the Panama canal zone, by which all goods entering the zone from foreign countries and for use in constructing the canal must pay the same tariff as if said goods entered the United States.

The Shipping Trust.—As a result of the recent conference of the five voting trustees of the International Mercantile Marine Company, in whose hands the control of the company was placed until 1907, Mr. J. Bruce Ismay is invested with absolute authority of management, and his decision is to be accepted as final. The five trustees are: Mr. J. Pierpont Morgan, the Right Honorable W. J. Pirrie, Mr. J. Bruce Ismay, Mr. Peter A. B. Widner, and Mr. Charles Steel.

BARGES NOS. 94 AND 95, FOR THE STANDARD OIL COMPANY.

There were recently added to the fleet of the Standard Oil Company two of the largest bulk oil-carrying vessels ever built in the United States. These vessels, which will in the future be known by the names of *S. O. Co. 94* and *95*, were built by the Townsend-Downey Shipbuilding Company of Shooter Island, New York city. Because of the great size and carrying capacity of these vessels the accompanying particulars, together with midship section and elevation, will be of special interest.

The specifications called for steel vessels to carry 1,800,000 gallons of oil in bulk, at weight of 7.66 pounds per gallon, and at a draft, when fully equipped for sea, not exceeding 24 feet to bottom of keel. To fulfill these conditions vessels of the following dimensions were designed.

Length, over all	374 ft. 6 in.
Length, between perpendiculars	360 ft. 0 in.
Beam, molded	50 ft. 0 in.
Depth, molded to main deck	21 ft. 0 in.
Depth, molded to spar deck	28 ft. 6 in.
Mean draft, loaded, fully equipped	24 ft. 0 in.
Displacement, at load draft	9,350 tons.

The general arrangement shows a well-proportioned vessel, having a continuous spar deck, with a forecastle about 48 feet in length for housing of towing engine, steam windlass, crew's quarters, store rooms, etc.; a continuous expansion trunk over oil compartments; a steel pilot house, standing above forecastle deck, and a steel house aft for steam-steering gear.

The officers' quarters are located at after end of vessel below spar deck, and are entered by a steel companion just forward of steering-gear house. These quarters are very commodious and most comfortably equipped, the specifications calling for ceilings finished with clear white-pine panels of neat design, sides, doors, berths, Venetian doors, and poles of quartered oak; all rooms furnished with plate-glass mirrors, white enameled iron wash stands with running fresh water, berths with drawers under, desks, chairs, settees with leather cushions, etc., and the floor to be covered with inlaid linoleum. The officers' lavatory is fitted out with white tiled floor, large porcelain-lined bath tub connected up for salt or fresh water, and a flushing water closet.

The crew's quarters, in forecastle, are finished in white pine and fitted out with three white enameled iron wash basins with running water, Lein-Irvine white enameled iron berths for eight men, and lockers for each man.

The pilot house, above forecastle deck, lighted by nine 24-inch diameter, extra-heavy brass lights, is finished inside in quartered white oak, with a floor of walnut and maple laid in narrow strips, and is fitted out with brass steering standard and hard-wood wheel, binnacle and compass, flag locker, desk, settee with leather cushions, etc.

The vessels are rigged with five steel masts, stepped on top of expansion tank, and extending 80 feet above spar deck. The foremast is 32 inches diameter at bottom and 27 inches at head, and arranged to act as a smoke stack for boiler, and the spanker mast 26 inches diameter at foot and 15 inches at top, and arranged to act as smoke stack from galley. Each mast is furnished with gaffs and booms for carrying sail, and care has been taken that all rigging is of ample strength. Shrouds and stays are of the best steel-wire rope, galvanized, and running rigging of best manila, with all blocks of the best five-roller bearing pattern.

Sails are hoisted by a Williamson 7- by 7-inch hoisting engine located on top of expansion trunk just forward of mizzen mast, leading sheaves being placed at bottom of each mast for this purpose. For towing purposes a patent towing chock is located at stem head and a 16- by 16-inch, No. 5 steam towing engine under forecastle deck, arranged for 3,000 feet of 6-inch circumference towing hawser of special make, having 37 wires to the strand. There are also supplied a 12-inch manila hawser of 90 fathoms, warps, and lines, as required by Lloyd's Register of Shipping for a vessel of this size.

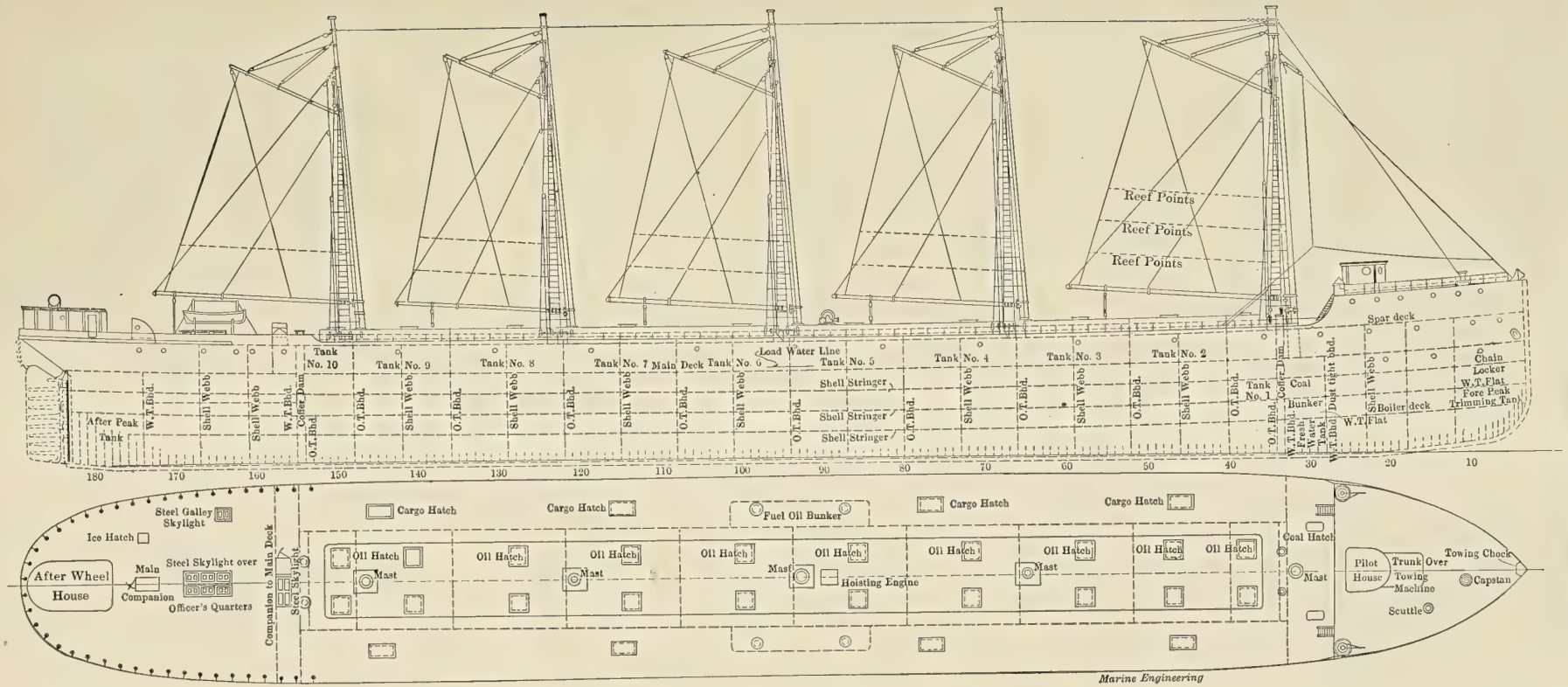
The windlass is located forward of towing engine, with a capstan standing above forecastle deck, and is of the Hyde pattern, with 12- by 12-inch vertical engines. An independent docking capstan is located aft on spar deck on starboard side of wheel house. Steering is done by a 7- by 7-inch Williamson steam and hand gear, with a brass standard and hard-wood wheel in forward pilot house for steering by steam, and a wheel in after house for both hand and steam.

The generating set, located in the boiler room forward, consists of a General Electric Company's single vertical engine, enclosed type, capable of running plant with full load at steam pressure of 80 pounds, but designed for a full working pressure of 125 pounds, connected on same bed plate with a 6-pole, 7-Kw. direct-current Westinghouse. The generator is a standard compound-wound machine having a capacity of 64 amperes at 110 volts. Separate wires are run without break from dynamos to an automatic indicator in pilot house, and from indicator to the port and starboard running lights, which are arranged for the use of either oil or electricity, and located in towers standing above forecastle deck.

Special care has been taken with the sanitary arrangements and steam heating of these vessels, all plumbing being of the latest style. A large fresh-water tank, of about 4,000-gallons capacity, is located at after end of main deck and gravity tanks on top of wheel house and pilot house, for supplying all wash basins, galley, water closets, baths, etc., with running fresh water. These tanks each have a steam pipe, controlled with valve, running through them, to prevent freezing of water in cold weather. In addition to the foregoing, a large fresh-water tank is built into vessel below coal bunker to hold 30,000 gallons, mainly for use of boiler.

The boiler room and coal bunkers are located at forward end of vessel, the bunkers having a capacity of about 100 tons of coal, and constructed absolutely oil tight, so that, by closing up of bunker doors, they may be used for oil fuel instead of coal, if so desired.

The boiler is of the Scotch type with two Morison suspension furnaces, and is 11 feet 6 inches in diameter by 11 feet 6 inches long, with 198 3-inch tubes, and constructed to work at a pressure of 120 pounds. The heating surface is 1,610 square feet and grate surface of 45 square feet. Located also in the boiler room is a 14- and 10- by 12-inch fire pump, a 5 1-4- and 3 1-2- by



DECK PLAN AND LONGITUDINAL OF ONE OF THE NEW STANDARD OIL BARGES.

6-inch feed pump, connected to draw from sea and fresh water; a Wheeler condenser having cooling surface of 500 square feet, and a Korting injector.

In the pump room, which is located at after end of vessel, are two oil pumps, size 18 and 14 by 24 inches, with 10-inch suctions and 8-inch discharges, a 5-foot blower for blowing gasses out of pipes, and a bilge pump 10 and 8 by 12 inches, the bilge and fire pumps being arranged as suction or discharge from any compartment, sea and deck.

The oil mains are 10 inches in diameter, one each side of center-line bulkhead, having two suctions from each tank. The main steam line is a 3 1-2-inch wrought-iron pipe, run between decks, and supplies steam to galley sink, radiators, three connections to spar deck, and all pumps.

As shown on the midship-section drawing, opposite the first page of this issue of MARINE ENGINEERING, special attention has been given to building the barges of sufficient strength and oil tightness to meet all the requirements of Lloyd's Register, in which the vessels are classed. It is especially worthy of note that these two ships are the largest merchant vessels ever built in New York city.

OIL ENGINES.

BY H. B. MAXWELL.

To Brayton, of this country, is, in all probability, due the credit of producing the first motor to use the heavier grades of petroleum. This motor was built in 1872, and only intended for stationary service. It was built to use the heat generated by burning the petroleum at constant pressure, and required auxiliary air and oil pumps, which consumed so large a portion of the indicated horse power that the mechanical efficiency was very low.

About 1888, Etèvé's patent was purchased by Priestman, who began the manufacture of the Priestman oil engine under this patent. This motor has a special spraying nozzle which sprays common kerosene oil into a retort heated by the exhaust gases from the cylinder; The retort is heated by a torch for starting. Fig. 1 gives a view of this device including the novel vaporizing jet. There is a recepticle for oil in the base of the engine and the eccentric, which operates the exhaust valve, also actuates an air pump which pumps air into the oil tank from which oil and air pipes run to their respective parts of the vaporizer jet. As the mixture from this jet is too rich to be effective there is an auxiliary air inlet controlled by a throttle connected to the same stem as the oil throttle, and both are operated by the governor. Ignition is by jump spark having both poles of the secondary circuit insulated and contained in one metallic plug which screws into the combustion chamber.

Right here the writer wishes to call attention to a vital point in gas or oil-motor design, a point that aids materially in getting the best results both in mechanical efficiency and fuel economy; it consists of putting the inlet and exhaust valves through the cylinder head, as per Fig. 2. This was later exploited by Buchet, of France, on air-cooled motors for cycles and light automobiles. In this country it was first used by the author on stationary motors, in 1895, and recently was adopted by John Wilkinson, of Franklin air-cooled motor fame, for automobile motors.

This is without doubt the most effective position for the valves, as the wall surface in the combustion space is reduced to a minimum and there are no ports or chambers to retard combustion; furthermore, the valve has an effective opening all around its circumference, which is not the case when placed in a chamber at the side of the cylinder proper. While it is somewhat difficult to operate the valves when placed in the cylinder heads, this arrangement will be more and more used as designers realize the advantages to be gained.

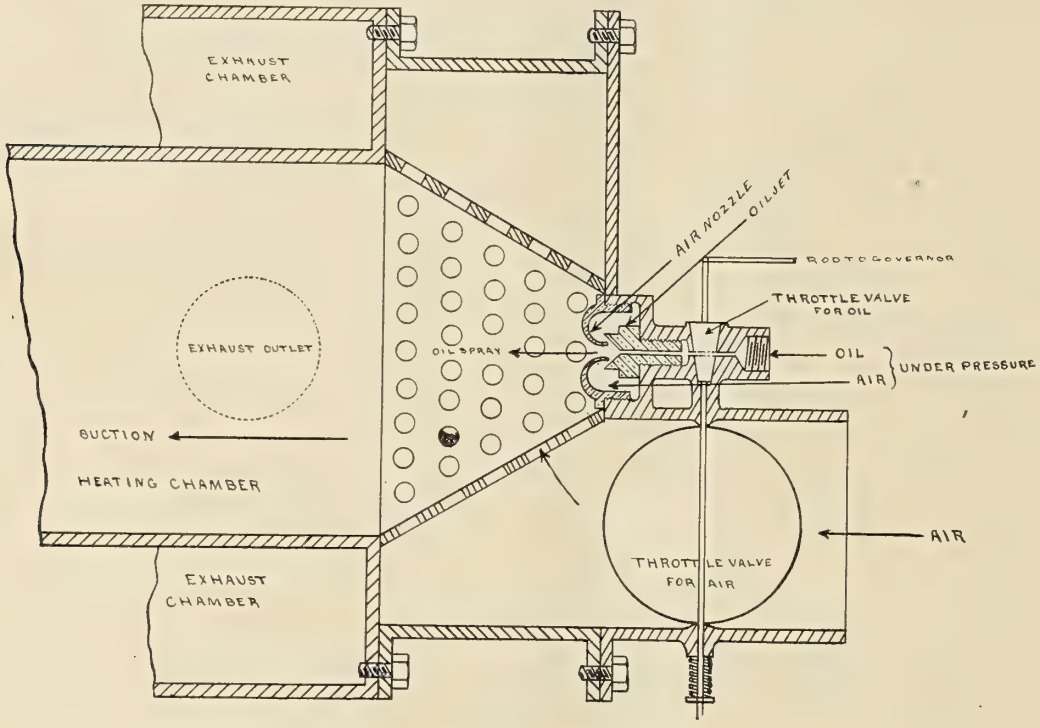


FIG. 1.—PRIESTMAN OIL ENGINE.

Next we have the Hornsby-Akroyd oil engine, which is entirely different from the Priestman, inasmuch as the oil is pumped into an unjacketed extension to the cylinder, as per Fig. 3. The oil vapor in the retort is too rich to explode until the piston returns and compresses the pure air, taken in on the suction stroke, into the retort, where it forms an explosive mixture and ignites from the heated walls of the retort at the proper time. This motor works best at nearly constant load, as at light loads the heat of the retort will diminish, resulting in uncertain ignition.

This engine, in modified form, is made in the east, while in the two-cycle style it is made on the Pacific coast under the name of the Hot Ball engine, and used for marine work. As the oil of the Pacific coast region

has an asphaltum base, this engine does not work as well as it would with Pennsylvania petroleum, owing to the asphaltum gumming up the piston rings and ports. There is one firm on the coast that makes a vaporizer for kerosene or crude oil, which can be used with any

drawn into the cylinder, and at near the end of the compression stroke the oil is forced into the cylinder by means of an air jet from the high-pressure reservoir; it is there ignited by the heat of compression, and holds up the pressure for a portion of the power stroke. There

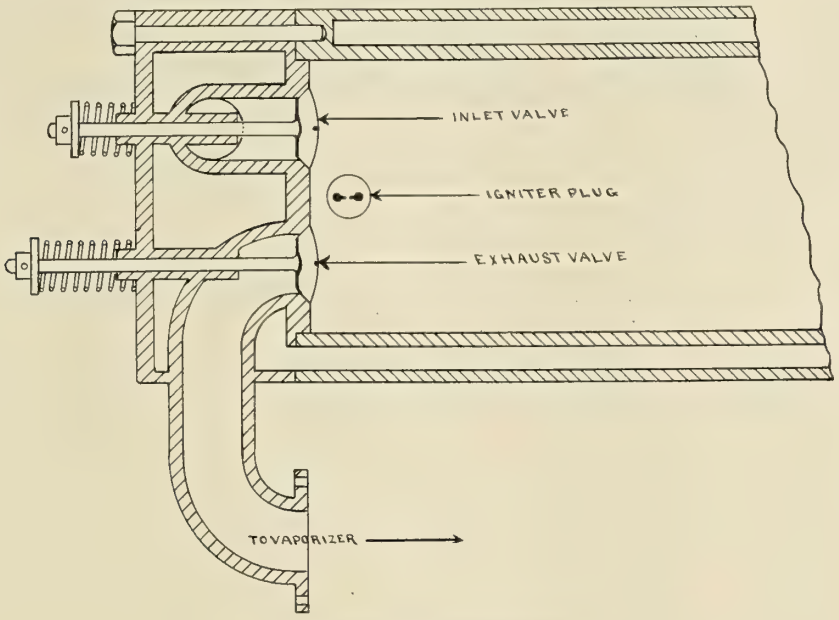


FIG. 2.—VALVES IN CYLINDER HEAD.

engine, and avoids this difficulty, and while the writer has never seen this device he believes from reports at hand that it is a success. It is adapted to either two- or four-cycle motors.

The Diesel oil motor is one that can be used for boat

is no explosion, as in other types of engines, and the oil supply being under control of the governor the oil used is proportional to the work done. An indicator card taken from this motor shows very plainly the point of cut-off of the fuel for various loads.

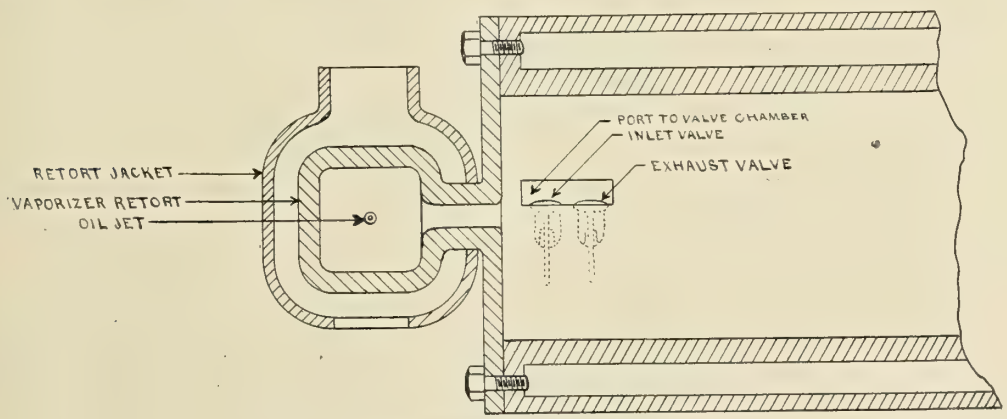


FIG. 3.—HORNSBY-AKROYD OIL ENGINE.

propulsion. In this motor high economy is claimed, and the claim is well founded. Extremely high compression is used, upwards of 500 pounds per square inch; the heat of compression is the only means of ignition. This motor requires an air pump for maintaining a pressure in the oil reservoir somewhat higher than the compression in the power cylinder. The motor operates on the four-cycle principle; on the suction stroke pure air is

In the Secor oil motor ordinary compression occurs; in the first engines the jump spark form of ignition was used, but later this was abandoned for a hammer-break sparker. The main feature of this motor is the manner of feeding the fuel; both oil and air valves are controlled by the governor but are capable of independent adjustment. By referring to Fig. 4 it will be seen that oil regulating valve and the air valve *J* are linked to-

gether and both are controlled by the governor lever *I* through the cranks *G, E, C,* and connecting rod *B*. *A* is a short lever with spring stop pin to engage in holes in disc *D* for oil-valve adjustment, the fine adjustment being made through slot in crank arm *C*. In the oil reservoir, which is of the constant level type, the kerosene oil is carried at a level of about one inch higher than the oil jet opening in the suction pipe. *K* shows a cup for holding gasoline, which is used for starting the motor, the needle valve *H* controlling the outlet into suction pipe. This motor gives good results and is well adapted for marine use.

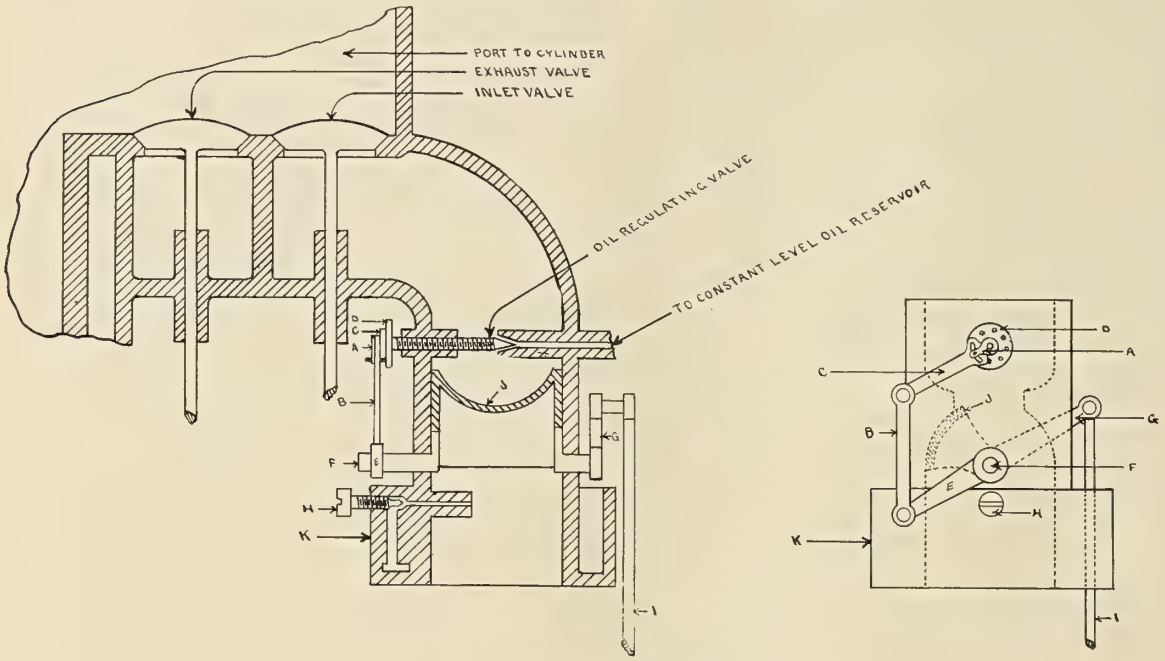


FIG. 4.—THE DIESEL OIL MOTOR.

The Metz and Weiss motor is of the two-cycle type, in which the oil is fed by a pump and injected into the cylinder at a point near the combustion chamber onto the plates *E, E, E,* shown in Fig. 5. The said plates are cast integral with the head; for starting the head is heated by a torch.

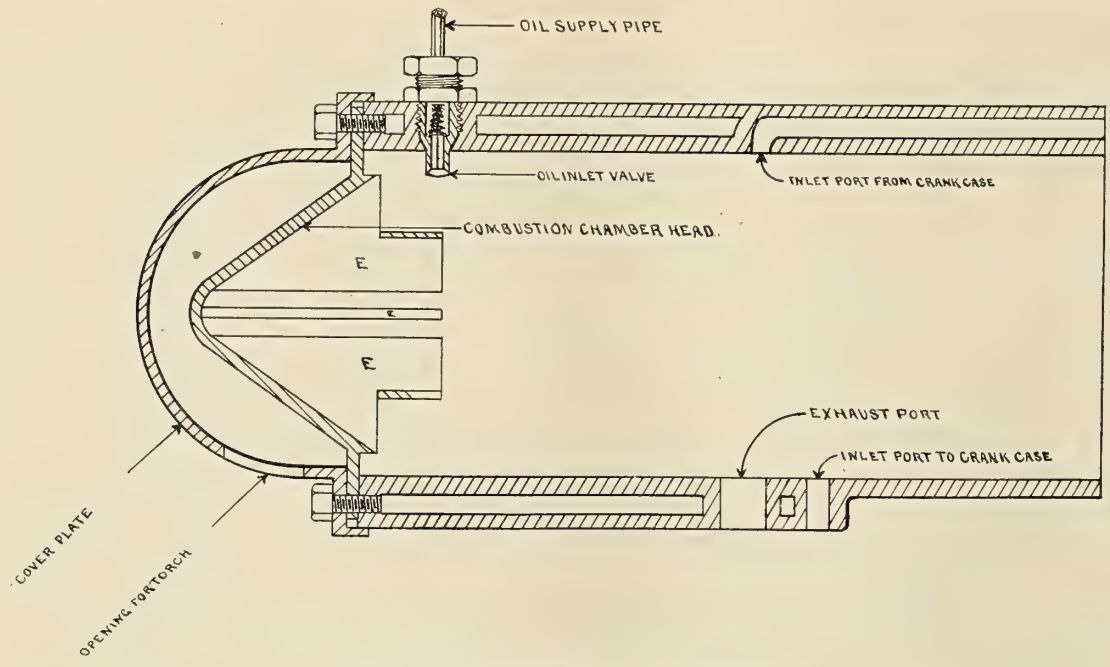


FIG. 5.—MIETZ & WEISS TWO-CYCLE OIL ENGINE.

The engine invented by Mr. H. G. Underwood possesses unique features, chief of which is the system of ignition. It is a two-cycle motor and has a small piston on the end of the main piston working in a cylinder cast on the head. In this cylinder the compression is high enough to ignite the charge, and the resulting flame is conveyed through a small outlet to the main combustion chamber and there ignites the main charge. This is a first-class motor for marine work. The main points are shown in Fig. 6. The oil is claimed to be fed by gravity or air pressure; the former is not practical unless a check valve is used to prevent the crank case compression forcing the oil back into the reservoir.

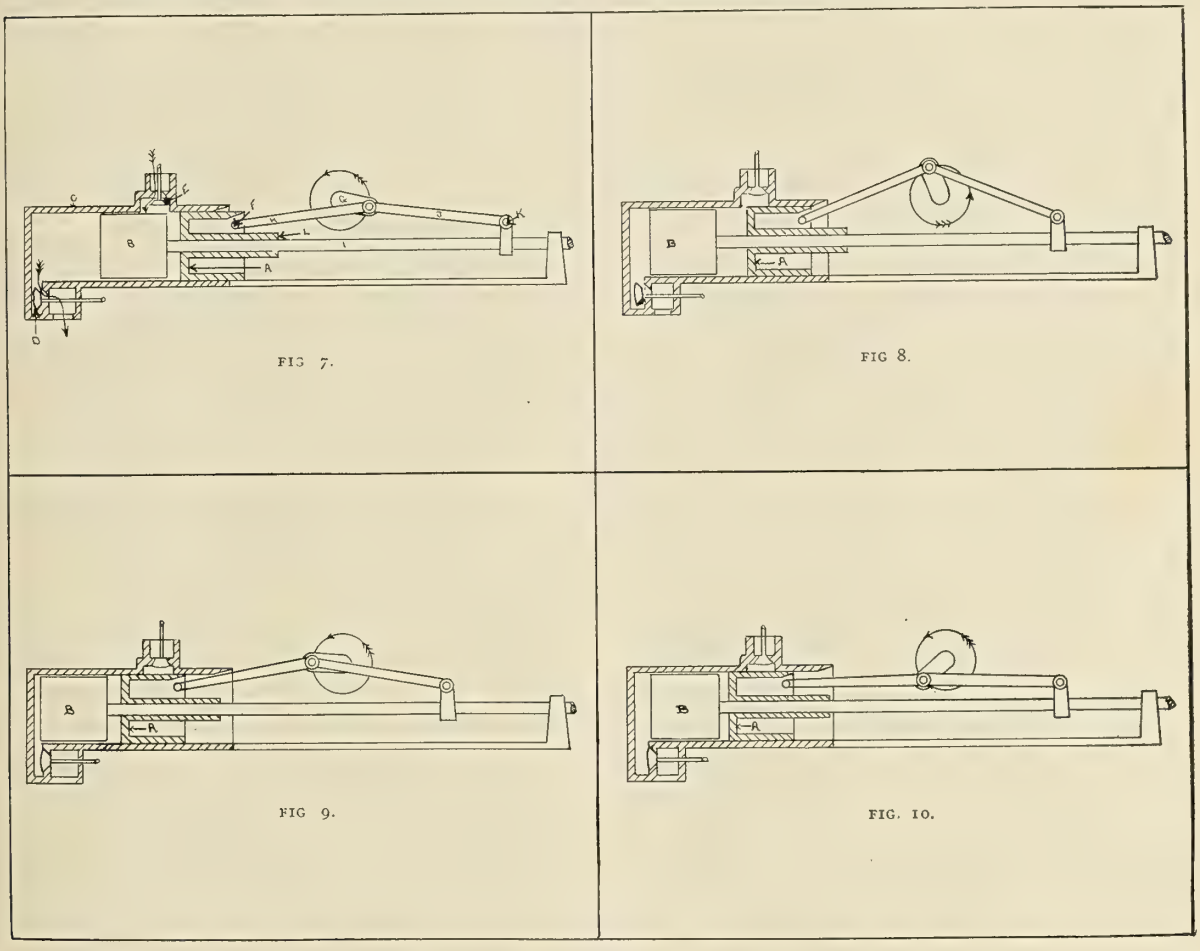


FIG 7.

FIG 8.

FIG 9.

FIG. 10.

TWO-CYCLE, OPEN-END CYLINDER MOTOR.

Probably the most novel oil motor is one illustrated in Fig. 7, and built in Chicago. It is a two-cycle motor with open-end cylinder and open crank case. By referring to the figure *C* is the cylinder, *A* the main piston, *B* an auxiliary piston having a check ring at the head end which allows the gases from between the pistons to escape to the combustion chamber. *B* is supported on rod *I* in the bearing in *A*. G is the crank to which are connected the rods *H* and *J*. *K* is the connection for rod *J* to rod *I*.; *F* is piston pin in *A* to which rod *H* is connected; *D* is the exhaust valve, mechanically operated, and *E* is an automatic inlet valve. Fig. 7 shows the beginning of the exhaust and suction strokes, the piston *B* moving toward the head of cylinder forces out the products of combustion and aspirates a fresh charge between the pistons *B* and *A* through the inlet valve *E*. Fig. 8 shows the beginning of the compression, *A* moving toward *B*, and forcing the charge by *B* into the combustion chamber. Fig. 9 shows completion of compression and the ignition point which is caused by the hot unjacketed cylinder head. Fig. 10 shows the power stroke under way. The head of motor is heated by a torch to start the motor. This engine will run as a hot-air motor by keeping the torch burning, but to get good power a mixture of gas and kerosene oil and air is fed to induction valve *E*. A double cylinder, 4 1-2 by 4 1-2, gives 5 brake horse power at 500 revolutions.

Last we will consider a kerosene motor that is a first-class solution of the problem of using the heavier grades of petroleum. It is a two-cycle motor possessing practically all of the advantages and none of the disadvantages of the Diesel motor. This motor is the invention of Mr. Oscar P. Ostergren, who was the first to produce liquid air in commercial quantities. It is designed to be made with two or more cylinders; Fig. 11 shows a section of the cylinder parallel with the crank shaft, while Fig. 12 a section at right angle thereto.

It is made with a cross-head similar to steam engine construction and uses the lower part of the cylinder for compressing a charge of pure air to about 7 or 8 pounds per square inch. The action is as follows, starting with

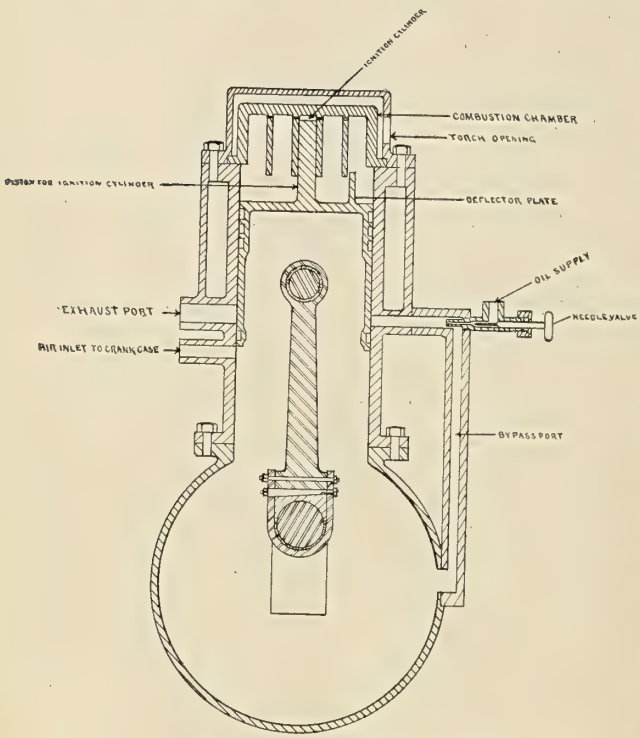


FIG. 6.—THE UNDERWOOD OIL ENGINE.

the piston down: As the piston rises air is admitted through the poppet valve *D* to the lower end of the cylinder; on descending, when the ports are as in Fig. 12, the air enters under the cap plate *C, C,* and is projected toward the top of the cylinder forcing the products of combustion of the previous charge out into exhaust chamber *G, G.* As the piston rises, part of the charge is admitted by ports *L* above and below the piston valve *M,* which is operated by a cam; when the piston is at the top, the plate *C, C,* closes the port *L,* and the piston *M* continues to rise and forces air through *Q* into *K,* and with the oil from *U* through *S* and *T* into the combustion chamber, where it is ignited on coming into contact with the hot cap *C, C.* Mixing with the heated air, when the piston descends, part of the charge escapes through valve *N* and port *R* to a reservoir in which the pressure is much higher than the compression pressure in the cylinder proper. This reservoir is used to feed the oil through the coil in the exhaust pipe *V,* shown in Fig. 12. The motor is governed by valve *I,* shown in Fig. 12, acting on the oil supply; in case the pressure in the cylinder should rise higher than the pressure in *Q* and *U,* the valve *J* seats itself. The compression pressure is about 200 pounds per square inch.

This article presents a few of the main types of the various oil engines, and, the writer thinks, covers the ground, for, while there are many different makes, they can be classified under some one of the types shown.

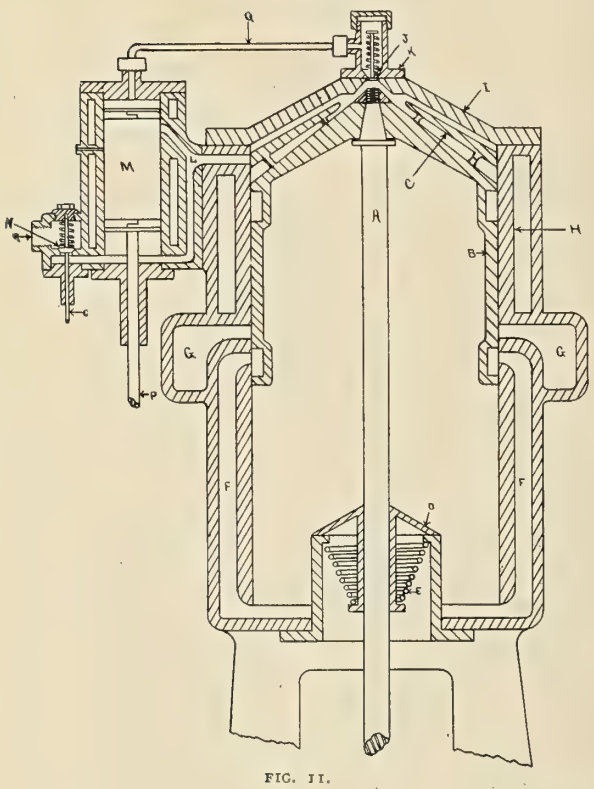


FIG. 11.

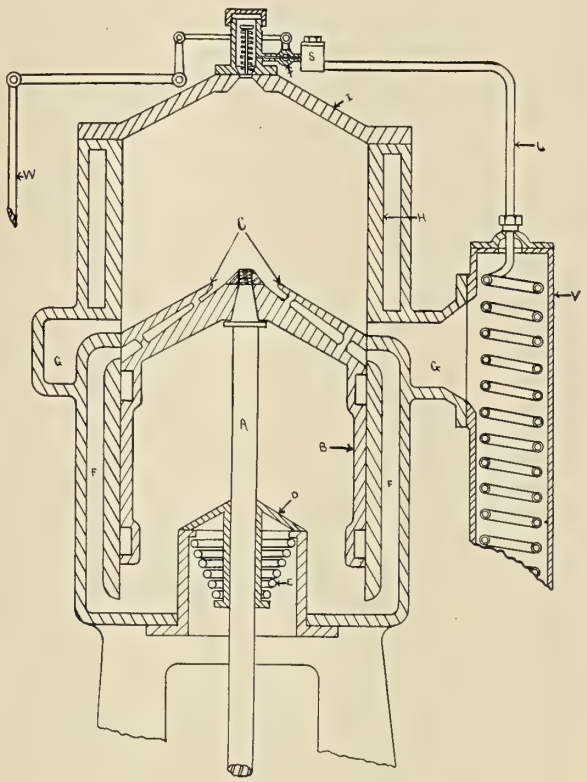


FIG. 12.

THE OSTERGREN KEROSENE MOTOR.

BREAKING UP THE OLD NEW BEDFORD WHALER ROUSSEAU.

The Passing of the New Bedford Whalers.

Fifty or so years ago the fleet of vessels sailing from New Bedford comprized three hundred or more sails. This fleet has steadily diminished until scarcely one of the old vessels is left. They were built "on honor," the timbers being heavy and of white oak, and the planking to correspond. They were all copper fastened, and whenever one of these whalers is put out of commission because of the cadence of the whaling industry, she is broken up and burned for the copper. Many a vessel has been found to contain from $2,000 to $3,000 worth of this metal. The illustration herewith shows the bark *Rousseau,* which was one of the most famous of the entire whaling fleet in the value of her voyages. One of the very last voyages made by a whaler was very profitable, as she brought home, in addition to a good cargo of sperm oil, about $20,000 worth of ambergris.

Ice-Breakers and Their Services.

At a recent meeting of the Institute of Marine Engineers, London, a paper was read by Mr. A. Gulston on "Ice Breakers and Their Services." In part he said that ice-breakers were of many forms and dimensions, varying from a steam launch of 40 feet to the immense ship *Ermack,* 8,000 tons displacement and 10,000 I. H. P. In 1870 appeared the first recognized ice-breaker, the tug *Pilot,* of Kronstadt, with specially-built bow. In '99 this boat was superseded by two small ice-breakers, *Zarja* and *Luna* of 150 I. H. P. each. These boats are used for towing purposes in the open season. The ports of Hamburg and Copenhagen followed the lead of Kronstadt, and at Hamburg there are now several ice-breakers. Although these vessels are not large, they were well designed and suitably arranged for the work they had to perform amongst the drift ice in the Elbe. The first ice-breaker at Copenhagen was the *Staerkodder,* of 800 I. H. P.; but the fine ice-breaker *Sleipner,* belonging to the harbor authorities, now controlled the winter traffic at Copenhagen. That vessel was of 2,000 I. H. P. and 1,450 tons displacement. The *Sampo* in the Gulf of Finland passed through field ice of 12 to 16 inches in thickness at 8 knots, and the thickness of the drift ice she had generally been at work in was some 8 feet to 10 feet, through which she could pass at from two to three knots.

Ordinary merchant steamers trading during the winter in ice-bound seas should have the plating at the bows doubled, and the side plating for some width above the water-line should be of a much heavier scantling than usual. The propeller blades should be of very strong design, and so fitted to the boss as to facilitate repairs. When that was done steamers could, to a large extent, take care of themselves.

At Reval there were four ice-breakers of varying dimensions, and the efforts of those vessels were supplemented by a well-arranged system of telegraphing all ships approaching the coast. There were also ice-breakers at Odessa, Kiel, Riga, Stockholm, Roscoff, Stettin, Libau, Amsterdam, Calmar, and Nicotisk, Vladivostock, &c.

The speaker then took up the design of ice-breakers and vessels suitable for working amongst ice. Those vessels, he said, should have the bow angles and lines so arranged that when they mounted the ice, and the ice was giving way under the vessel's weight, they would not jamb when returning to be water-borne forward, always remembering that they were advancing and should remount the ice. An ice-breaker should also be able easily to turn out of the channel she had cut, and the form of the bow lines had much effect on that manœuvre. The designs of ice-breakers varied so much that there was no certain data to guide builders, but practice had shown that the full forward form, or spoon-shaped bow, was not successful in hard and packed ice, as the vessel pushed the ice in front of herself, instead of cutting and dispersing it. Additional stringers, stronger decks, and a liberal addition to the number of bulkheads, transverse and longitudinal as well as many pillars, became a necessity to prevent the constant recurrence of repairs. All piping should be kept under the deck, and the fire pipes should be fitted with hydrants below and above that deck. The boiler-rooms must be well closed up, and consideration had to be given to the disposal of the ashes. The rudder should be arranged for easy unshipment afloat, and should be of large area and immensely strong. The moving parts of the machinery and the shafts must be extra strong and largely in excess of ordinary practice. On the engines it was preferable to have direct steam reversing gear, as the "all-round" type was a very heavy tax on the engineers when the ship was ice-breaking. The vessel should be so designed that, if possible, she could be tipped to replace a propeller blade whilst afloat.

The speaker then proceeded to describe the ice-breaking passenger and mail steamers. There were, he said, not many of those vessels at work, and they were not able to force the packs so readily as an ice-breaker could. Three vessels of that type, the *Express* and the *Åbo,* running between Stockholm and Hango, and the *Bore,* running between Stockholm and Abo, kept up a steady time-table throughout the winter. After referring to various vessels of that type, the lecturer described the *Stanley,* an ice-breaking mail boat belonging to the Canadian Government, and engaged in running between Prince Edward's island and Newfoundland. The *Britannia*—the first steamer of the Cunard Company—was next dealt with. That vessel, Mr. Gulston observed, became imprisoned in the ice at Boston, Mass., in 1844, and the people of the town arranged to help to cut her out. That project was carried through by sawing and breaking the ice, and by the aid of her paddle-wheels she reached the open water. The distance that the *Britannia* had to be cut out was seven miles, and at that date that was a remarkable undertaking.

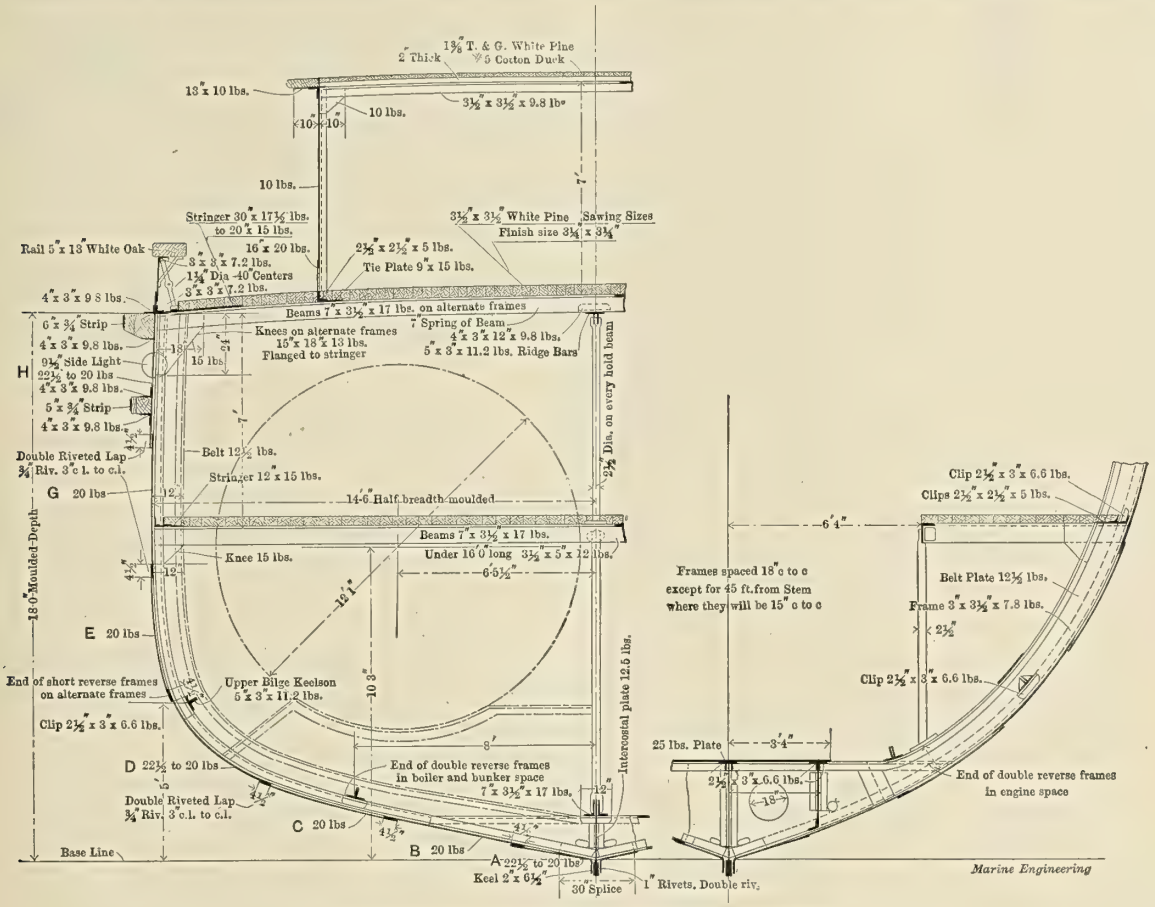
Another type of vessel for use in winter was the railway ferry ice-breaking steamer. Some of these vessels were of great size, and those best known were used on the Danish State Railways, between the islands of the Great Belt and the mainlands. There were also the famous railway ferry ice-breakers at Saratoff, on the River Volga. As those two steamers had to pass through the system of locks on the Marinsky canal from Lake Ladoga to the River Sweir, and so to the Volga, it had been necessary to build them so that they could be parted to enter the locks—the ice-breaker in halves and the railway ferry into four portions. The next described was the *Scotia,* also built at Walker-on-Tyne. She had been constructed to the order of the Inter-Colonial Railway, of Canada, for service across the Strait of Canso, between Cape Breton island and Nova Scotia. She was a typical ice-breaker. Either end of the vessel was intended to be bow or stern at will, so that in working it was not necessary for her to turn round when entering or leaving her landings. On her deck she had three sets of rails, and was designed to carry nine Pullman or corridor bogie sleeping cars 80 feet long, each weighing 52 tons unloaded. The lecturer then described the railway ferry ice-breaking steamers *St. Marie* and *St. Ignace,* which plied across the Straits of Mackinaw, between Lake Huron and Michigan, a distance of seven miles. Both those boats were built of oak, sheathed with iron in way of the water-line.

After describing yet other vessels of the same type for use in American waters, Mr. Gulston proceeded to give a detailed account of the building and working of the famous ice-breaker *Baikal,* running on Lake Baikal, in the centre of Siberia. The vessel was built to connect the eastern and western ends of the Siberian Railway, which, as they knew, made a continuous railway from Ostend to Vladivostock in Eastern Siberia and Port Arthur in Manchuria. The distance of the ferry across the lake was fifty-two miles. The *Baikal* was built on the Tyne. The hull was completely erected, marked, taken down and shipped inside of six months, and 2,700 tons weight in 6,900 packages had to be transshipped for some 1,500 miles across Siberia by boat to the place of re-erection. The boilers, of which there were fifteen, had to be kept under 20 tons in weight for trans-shipment purposes. The next vessel to be considered was the *Ermack,* which had been built for Polar enterprise, as well as for ice-breaking in the Baltic. The speed of the *Ermack* through 24 inches of solid ice, with 6 to 12 inches of snow on it, was 9 knots, and she could charge and demolish packs of ice 20 to 23 feet thick. In Polar ice the speed had to be kept at about from 2 1-2 to 3 1-2 knots. She had proved herself to be of enormous use on her station on the Baltic coast of Russia, where she could negotiate any ice and could safely bring out of danger all steamers that she went to assist. Indeed, in one season she rescued and assisted shipping of over £2,000,000 value, and in another winter she salved the Russian battleship *Grand Admiral Aprixine,* of £750,000 value. With the *Ermack* in the Baltic there was no difficulty in Russia putting her fleet to sea, which usually wintered at Kronstadt, as the *Ermack* could easily guide them to open water should necessity arise, and there was nothing to prevent that vessel herself being made into an armored cruiser.

Ocean-Going Steel Tug Conestoga.

Towing coal in barges along the coast has required an increasing fleet of barges and tug boats. The Philadelphia and Reading Railroad Company, which owns many a craft of this kind, has recently had built at the yards of the Maryland Steel Company the tug *Conestoga*, much similar in size and design to other large sea-going tugs of this company's fleet. These tugs are under steam, with but short intermissions, for months at a time. As soon as they bring one tow of barges into port another one for the return trip is assembled and the tug boat starts out to sea with only a few hours' delay for coaling and taking on provisions and stores.

The *Conestoga* is heavily built throughout, being in


1⅜" T. & G. White Pine
2" Thick
⅝ Cotton Duck
13"x 10 lbs.
3½"x 3½"x 9.8 lbs.
10 lbs.
10 lbs.
Stringer 30"x 17½ lbs. to 20"x 15 lbs.
3½"x 3½" White Pine Sawing Sizes
Finish size 3¼"x 3¼"
Rail 5"x 13" White Oak
16"x 20 lbs.
2½"x 2½"x 5 lbs.
Tie Plate 9"x 15 lbs.
3"x 3"x 7.2 lbs.
1¼" Dia. 40" Centers
3"x 3"x 7.2 lbs.
4"x 3"x 9.8 lbs.
Beams 7"x 3½"x 17 lbs. on alternate frames
7" Spring of Beam
6"x ¾" Strip
Knees on alternate frames 15"x 18"x 13 lbs. Flanged to stringer
4"x 3"x 12"x 9.8 lbs.
5"x 3"x 11.2 lbs. Ridge Bars
4"x 3"x 9.8 lbs.
9½" Side Light
22½ to 20 lbs
4"x 3"x 9.8 lbs.
5"x ¾" Strip
4"x 3"x 9.8 lbs.
Belt 12½ lbs.
Double Riveted Lap ¾" Riv. 3" c. l. to c. l.
Stringer 12"x 15 lbs.
G 20 lbs
14'-6" Half breadth moulded
Beams 7"x 3½"x 17 lbs.
Under 16'0" long 3½"x 5"x 12 lbs.
Knee 15 lbs.
6'-5½"
12'1"
18'0" Moulded Depth
E 20 lbs
End of short reverse frames on alternate frames
Upper Bilge Keelson 5"x 3"x 11.2 lbs.
10'3"
Clip 2½"x 3"x 6.6 lbs.
8'
D 22½ to 20 lbs
End of double reverse frames in boiler and bunker space
7"x 3½"x 17 lbs.
Intercostal plate 12.5 lbs.
Double Riveted Lap ¾" Riv. 3" c. l. to c. l.
C 20 lbs
B 20 lbs
A 22½ to 20 lbs
Base Line
Keel 2"x 6½"
30" Splice
1" Rivets, Double riv.
2½" Dia. on every bold beam
Clip 2½"x 3"x 6.6 lbs.
Clips 2½"x 2½"x 5 lbs.
6'4"
Frames spaced 18" c to c except for 45 ft. from Stem where they will be 15" c to c
Belt Plate 12½ lbs.
Frame 3"x 3½"x 7.8 lbs.
2½"
Clip 2½"x 3"x 6.6 lbs.
25 lbs. Plate
3'4"
2½"x 3"x 6.6 lbs.
18"
End of double reverse frames in engine space
Marine Engineering

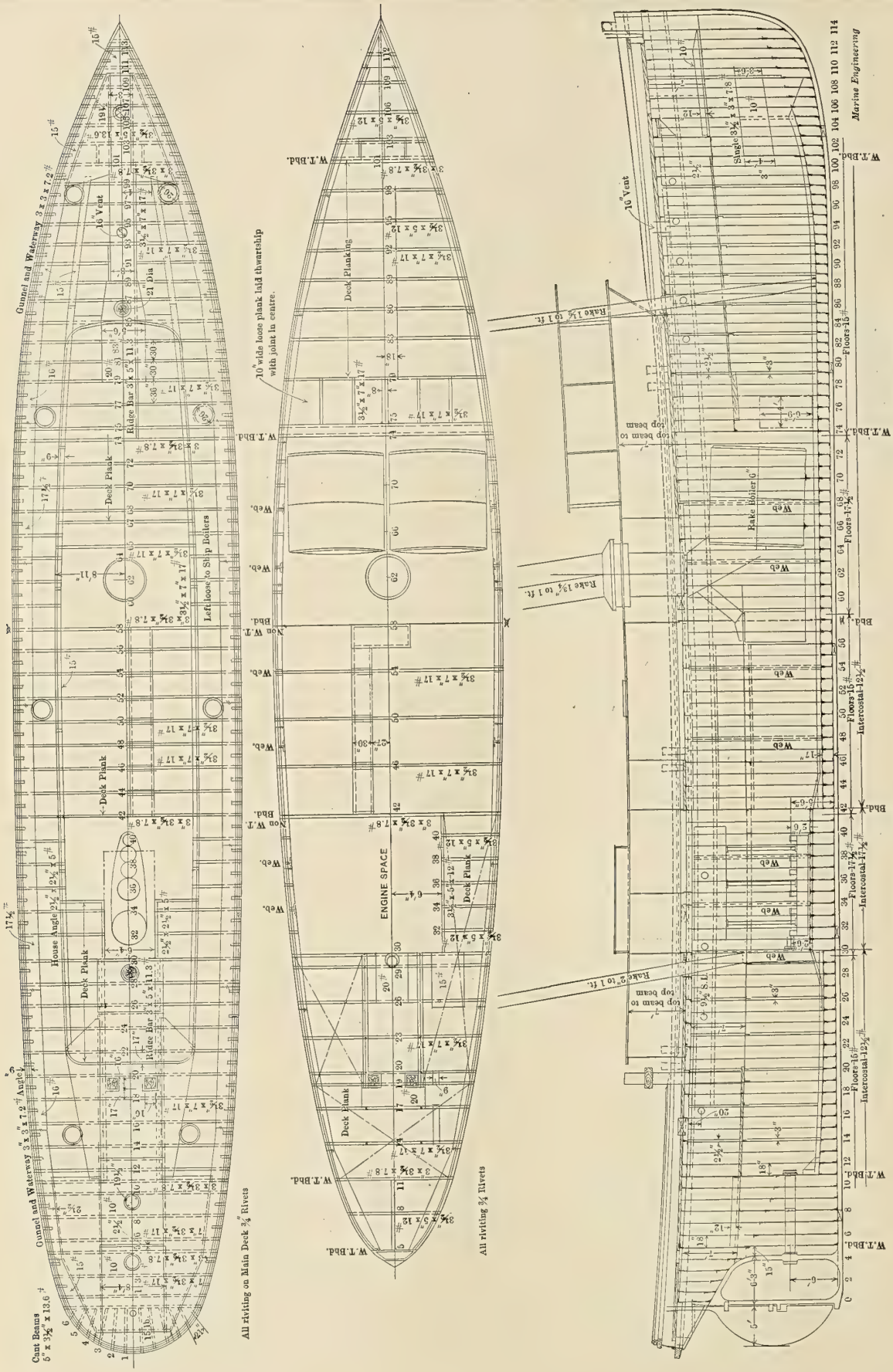
MIDSHIP SECTION OF THE OCEAN-GOING STEEL TUG CONESTOGA.

MARINE ENGINEERING DATA CARD. **AUGUST, 1904.**

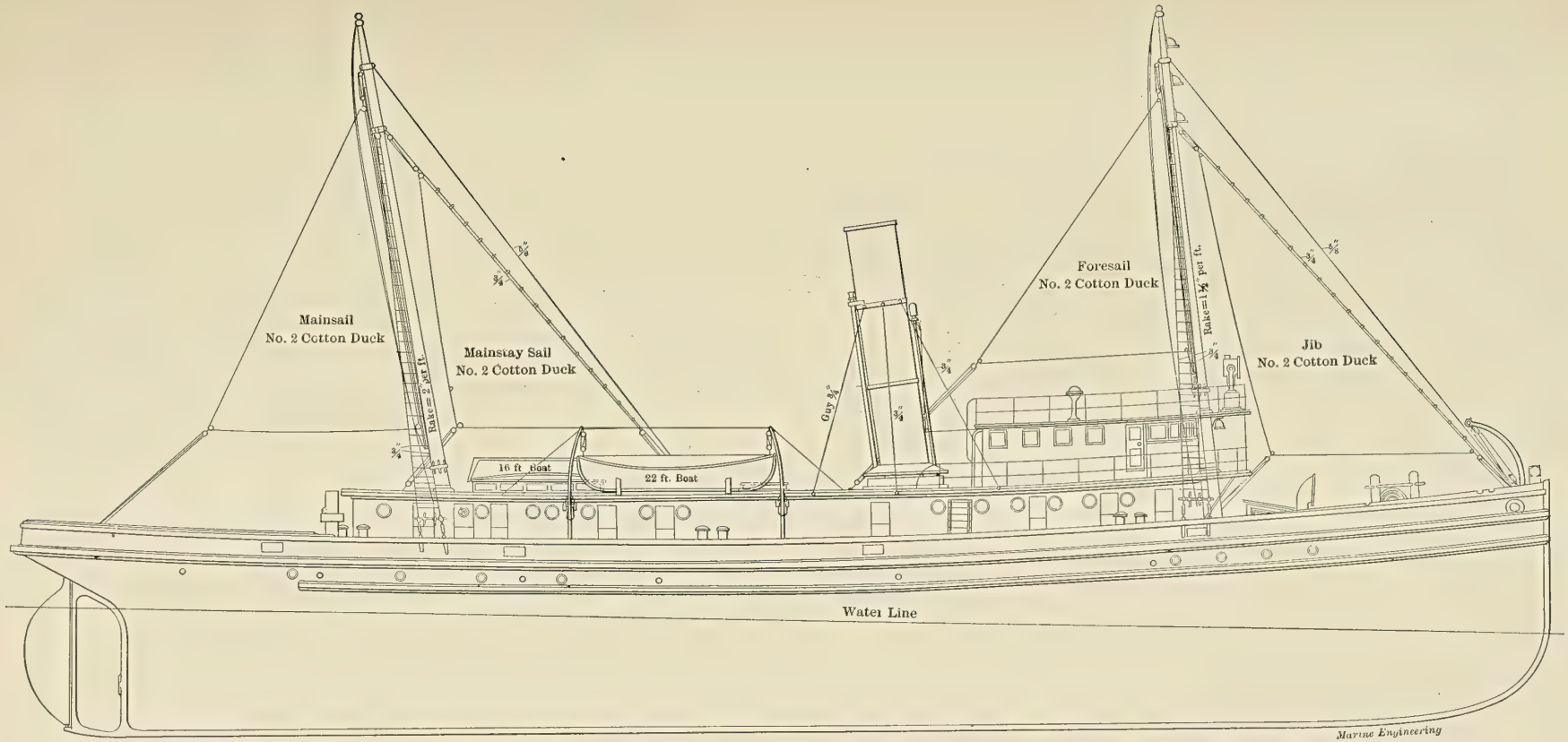
NAME—Conestoga. NATIONALITY—American. TYPE—Ocean tug.

LAUNCHED—1904. BUILDERS—Maryland Steel Co. OWNERS—Philadelphia and Reading R. R. Co.

Length over all	170 ft. 0 ins.
" between perps	163 " 6 "
Beam, molded	29 " 0 "
Depth at side	18 " 0 "
Load draft	14 " 0 "
Trial "	11 " 3 1-2 "
Displacement, load	950 tons
" trial draft	590 "
Tonnage, gross	612
" net	420
Engines: Number	one 3-cylinder triple expansion
Cylinder diameters	18, 28 and 45 ins.
Stroke	30 ins.
Shaft, crank diameter	9 "
" tail "	9 1-8 "
Condens. built in	1,588 sq. ft.
Circulat. pump, suction diameter	9 ins.
" " engine	7 by 7 "
I. H. P.	1,000
Propellers: Diameter	11 ft.
Pitch	13 "
Area	50 sq. ft.
Boilers: Number	two Scotch
Diameter	12 ft.
Length	12 ft. 6 ins.
Working pressure	170 lbs.
Furnaces: Number	three
Diameter	35 ins.
Tubes, diameter	3 "
	Common combustion chamber.
G. S. two boilers	113.7 sq. ft.
H. S. " "	3,168 " "
Donkey boiler	46 ins diameter by 7 ft. height


Gunnel and Waterway 3" x 3" x 7.2#
Deck Plank
Rider Bar 3½" x ½" x 11.3#
House Angle 2½" x 2½" x 5#
Gunnel and Waterway 3" x 3" x 7.2# Angles
Cant Beams 5" x 3½" x 13.6#
All riveting on Main Deck ¾" Rivets
Deck Planking
10" wide loose plank laid thwartship with joint in centre.
W.T.Bhd.
Web.
Non W.T. Bhd.
ENGINE SPACE
All riveting ¾" Rivets
10" Vent
Rake 1¾" to 1 ft.
Rake 2" to 1 ft.
Fake Boiler 9"
Floors 15#
Floors 17½#
Intercostal 12½#
Intercostal 10½#
Sluice 3½" x ½"
Marine Engineering

DECK PLANS AND LONGITUDINAL OF THE OCEAN-GOING TUG CONESTOGA, BUILT BY THE MARYLAND STEEL COMPANY.

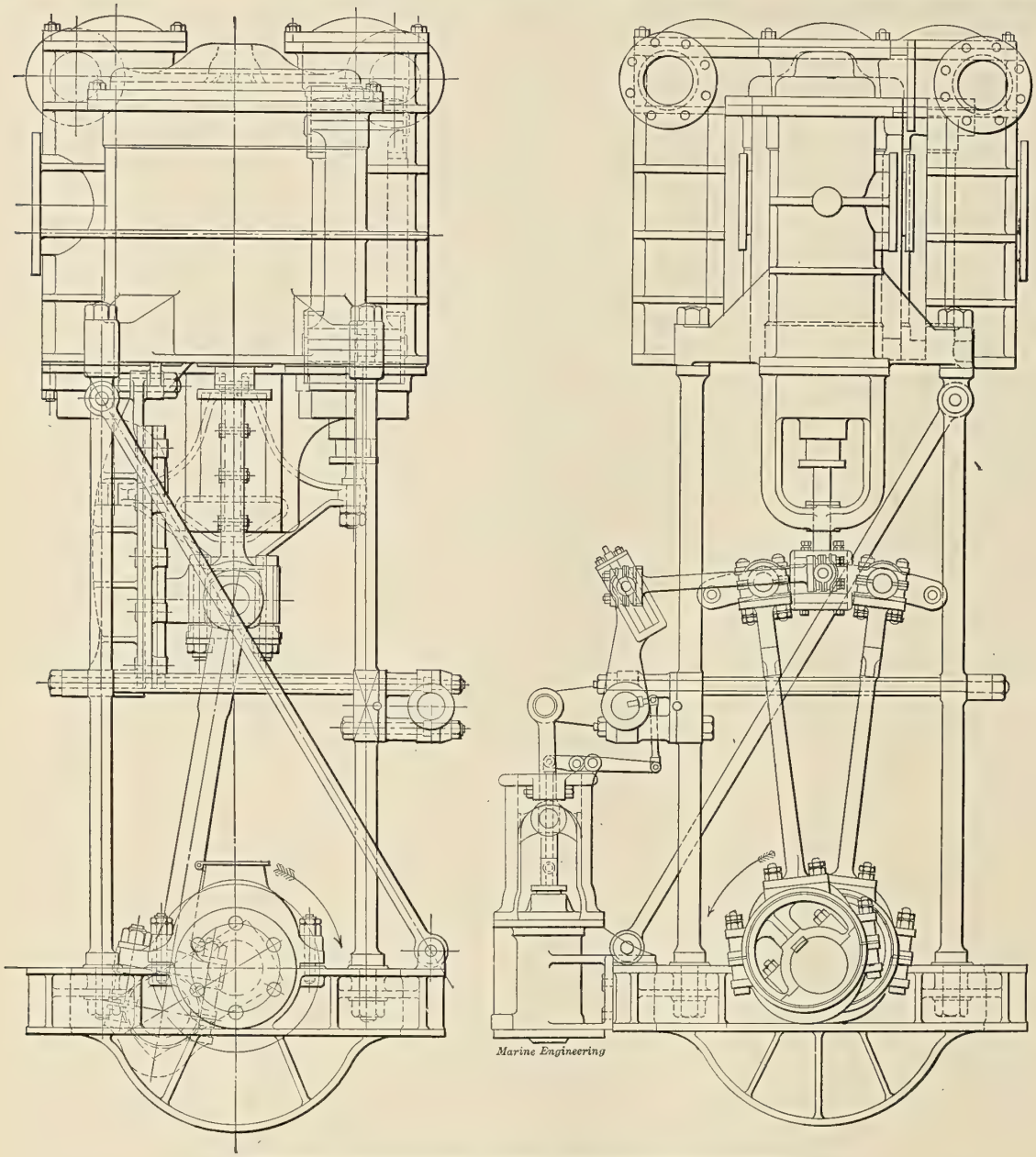


SAIL PLAN OF THE OCEAN-GOING TUG CONESTOGA.

excess of the classification of the American Bureau of Shipping. The general character of the boat is plain and substantial, specially fitted for heavy work. The scantlings are given in the midship section on page 365, while the general arrangement is shown in the deck plans and longitudinal on page 366. The hull is divided by four water-tight bulkheads to the main deck, as shown in the longitudinal. The lower deck is worked in forward of the boiler room and aft of the engine-room space. The crew have accommodations forward on the lower deck, and in the large deck house are the dining room, galley, and toilet rooms. In this deck house are also the officers' quarters, and on top is a large pilot house with captain's room.

The equipment of the deck machinery is heavy throughout and consists of one steam gypsy with a 5 by 8-inch double engine of the Hyde make, a Hyde windlass for 1 1-4-inch chain and fitted with bitts, and a Williamson steam-steering engine 4 1-2 by 4 1-2-inch double cylinders. A large towing machine for a 1 5-8-inch wire hawser is placed in the aft end of deck house. Very heavy towing bitts are fitted, as shown on the deck plan aft. Large coal bunkers are provided midships. Fresh water is carried in the peak tanks forward and aft.

The engine is triple expansion, with cylinders 18, 28, and 45 inches diameter by 30 inches stroke, to develop about 1,000 horse power. The full equipment of independent pumps for fire, feed, sanitary, and wrecking purposes is installed, while the air, bilge, and feed pumps are direct connected to the main engine. Two large Scotch boilers furnish steam at 170 pounds pressure. Each is fitted with three Morison furnaces 35 inches diameter, entering into a common combustion chamber. The vessel is electric-lighted throughout by current from one 80-ampere and one 40-ampere machine. Other particulars will be found in the data card.



HIGH-SPEED, TRIPLE-EXPANSION ENGINE FOR AN AUXILIARY SCHOONER.

Low-Pressure Cylinder, Looking Forward. Scale: 3-4 Inch = 1 Foot. High-Pressure Cylinder, Looking Aft.

Auxiliary Engine of a Three-Masted Schooner.

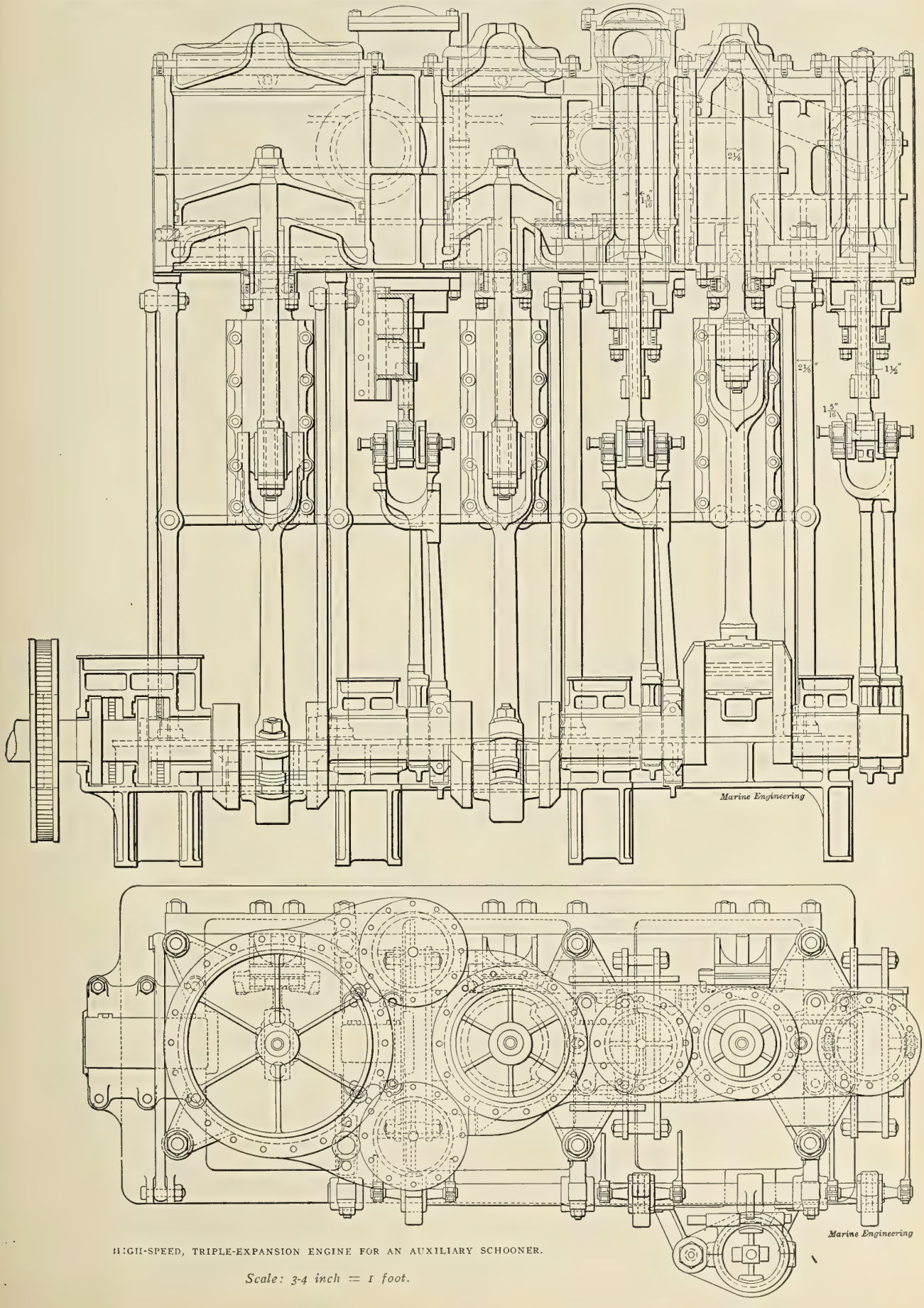
This engine is of the triple-expansion type with diameters of cylinders 9, 14, and 22 1-2 inches, having a common stroke of 16 inches, running at 235 revolutions. The engine is designed to indicate about 400 horse power with a boiler pressure of 250 pounds per square inch. The arrangement of the cylinders and valves is as follows:

High-pressure piston valve, high-pressure cylinder, intermediate-pressure piston valve, intermediate-pressure cylinder, low-pressure piston valves, low-pressure cylinder.

Each cylinder and valve chest are made in one casting of close-grained cast iron, and piston valves are fitted with cast iron liners. They are provided with relief valves, drain cocks, indicator cocks, etc., lagged with magnesia, and covered with Russia sheet iron with brass strips. The cylinder covers have coverings of pressed sheet brass and are turned bright like the piston valve covers. The cylinders are supported at the front and back by eight wrought steel columns turned bright, with diagonal braces, and they are held together by machine bolts, as shown in the drawing.

The entire bedplate is made in one piece of cast iron and has four cross joints providing journals and thrust bearings. The main bearing caps are of cast iron, the bottom bushes are of brass, both lined with white metal.

The pistons are of cast iron, dished type, and fitted with two open piston rings. The piston rods, of wrought steel, are 2 1-8 inches in diameter. Both piston rod and



HIGH-SPEED, TRIPLE-EXPANSION ENGINE FOR AN AUXILIARY SCHOONER.

Scale: 3-4 inch = 1 foot.

valve-stem stuffing boxes are of brass and fitted with Katzenstein's metallic packing.

Piston rods and slipper crossheads are forged in one piece. Crosshead guides, being of cast iron, have two brass guides for astern going, and are bolted with one side to the cylinders, with the other side to a wrought-steel bar, which connects all back columns.

The connecting rods, which are 38 inches between centers, are 3 inches diameter at crank end, and 2 7-16 inches at fork end.

Crank ends have brass boxes lined with white metal 4 7-8 inches in diameter by 8 inches long, while crosshead ends are solid joint with the crosshead pins, which are 3 inches in diameter by 4 7-8 length.

The high-pressure cylinder has one piston valve of 6 1-2 inches diameter, the intermediate-pressure cylinder has one piston valve 7 1-2 inches diameter, and the low pressure has two piston valves of 8 1-2 inches diameter each. All valves take steam on the outside and have a common stroke of 4 inches. The valve-stem guide brackets are cast on the bottom valve-chest covers, and the low-pressure valve-stem guide brass crosshead runs in cast iron guides, which are made in halves, each half part cast on the bottom of one of the low-pressure valve-chest covers.

The valve-stem guides are fitted with hard composition boxes, in halves, held in place by set screws. All valve stems are of wrought steel, with the lower end forged large enough for composition boxes, which are made in halves. The diameter of valve-stems at guide and stuffing boxes are 1 1-2 inches reduced to 1 5-16 inches where they pass through the valves.

The link blocks are of open-hearth steel, annealed after forging, and finished all over. They have at each end a pair of jaws to span the corresponding bar of the link. The jaws are fitted with brass gibs, finished to the curve of the links, and have tap bolts for adjustment. The diameter of pin is 2 7-16 inches with 1 5-16 axial hole.

Each reversing link is suspended from the corresponding arm on the reversing shaft by suspension links, with ends fitted with brass bushes made in halves. The reversing shaft is 2 5-8 inches in diameter with cast-steel arms; reversing arms are arranged for linking in and out. The eccentric rods are of wrought steel; each rod has a T head secured to its eccentric straps by two studs. The upper end of each rod is forked to span the links and fitted with composition bearings.

The eccentric straps are of brass. Each strap is lined with white metal fitted into dovetailed recesses and hammered in place. The eccentrics are made in two parts, the larger part of cast iron and the smaller part of forged steel. The reversing gear consists of a direct-acting steam cylinder controlled by the usual floating levers.

The crank shaft is forged in one piece and the sequence of cranks is as usual, namely: high, intermediate and low. The thrust bearing is built according to standard construction and is fitted on astern-going side with white metal.

The main feature of this engine is the very closed arrangement and light yet strong construction; valve chests carried out on top and bottom, thence giving straight and large steam ports, and roller thrust bearing.

ENGINE DATA.

Engine 9, 14 and 22 1-2 inches by 16 inches
R. P. M. 235 pounds.
Boiler pressure 250 pounds.
Connecting rod, length, 38 inches.
Valves, piston, one on H. P, one on I. P., two on L. P.
Diameter 6 1-2, 7 1 2 and 8 1-2 inches.
Travel 4 inches.
Steam taken on outside.
Eccentric rod, length, 34 inches.

Cylinders.	H. P. and I. P.		L. P.	
	Top	Bottom.	Top.	Bottom.
Width of port, ins.	1 1/4	1 1/4	1 3/4	1 3/4
Steam lap. ins	1 1/16	1 1/16	1	5/8
Exhaust lap, ins	5/16 neg.	3/32 pos.	1/8 neg.	5/16 pos.
Angular advance, degrees	33	33	38	38
Steam lead, angular, "	6	7 1/2	9 1/2	10 1/2
" " linear, ins	11/64	15/64	17/64	5/16
Cut-off, ins	12 8	11.52	11.96	10.6
Per cent. stroke	.80	.72	.7475	.663
Release, ins	14.44	14.56	14.470	14.62
Per cent. stroke	.9025	.91	904	.914
Compression, ins	96	1.152	1.87	1.968
Per cent. stroke	0.060	0.072	117	.123
Steam opening, ins	1 1/16	1 3/16	1	1 1/8
Exhaust opening	Full	Port	Full	Port.

The Merchant Marine in the Political Platforms.

The platforms adopted by the republican and democratic national conventions contain clauses on the merchant marine each of which is expressed in no uncertain language. That adopted by the democrats is as follows:

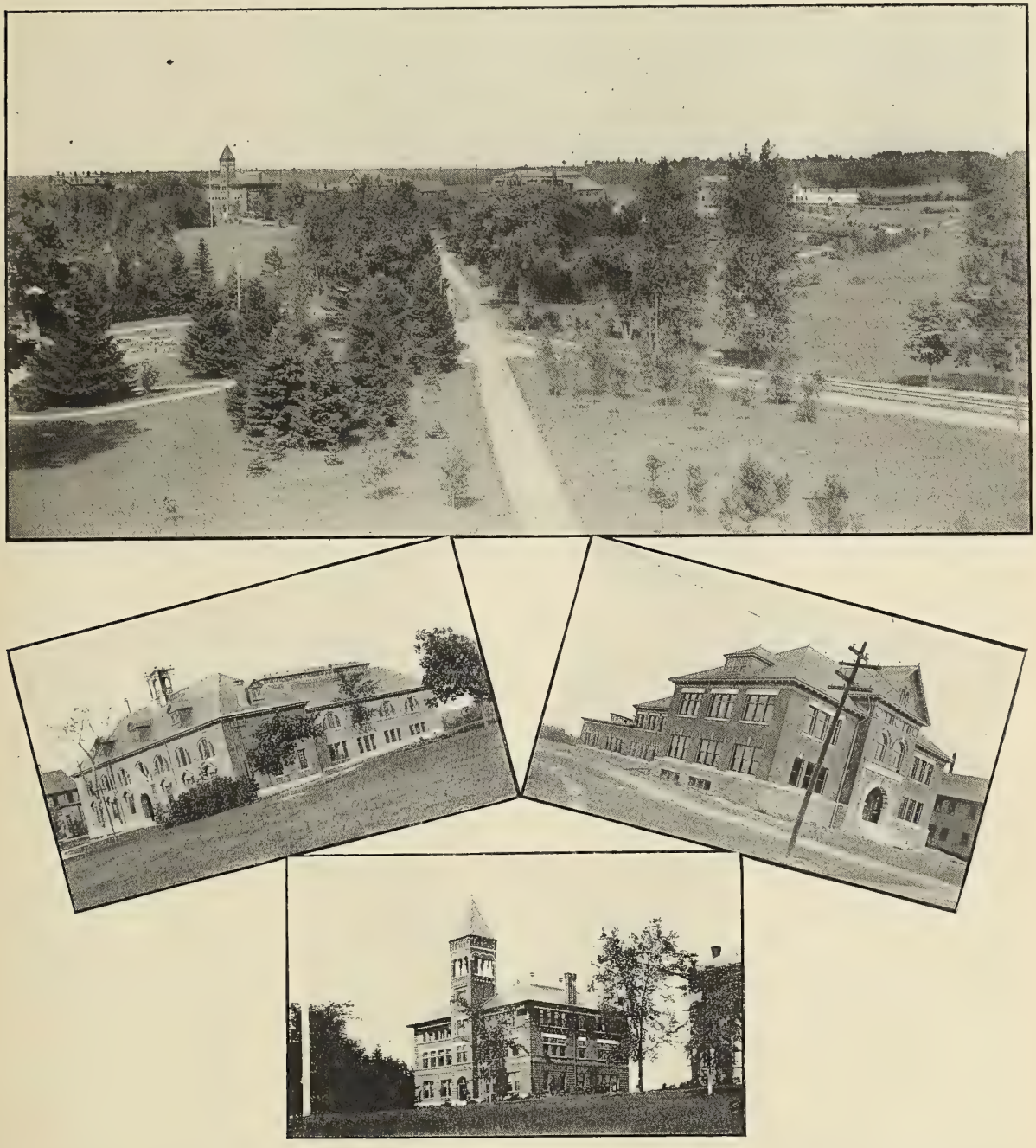
"We denounce the ship subsidy bill recently passed by the United States Senate as an iniquitous appropriation of public funds for private purposes, and a wasteful, illogical, and a useless attempt to overcome by subsidy the obstructions raised by republican legislation to the growth and development of American commerce on the sea.

"We favor the upbuilding of a merchant marine without new or additional burdens upon the people and without bounties from the public treasury."

The republican platform is as strongly in favor of subsidy as the democratic is opposed to it. The platform also contains a statement of a naval policy to be adopted. On this question the democratic platform is silent.

"While every other industry has prospered under the fostering aid of republican legislation, American shipping engaged in foreign trade in competition with the low cost of construction, low wages, and heavy subsidies of foreign governments has not for many years rereceived from the government of the United States adequate encouragement of any kind. We therefore favor legislation which will encourage and build up the American mercantile marine, and we cordially approve the legislation of the last congress which created the Merchant Marine Commission to investigate and report upon this subject.

"A navy powerful enough to defend the United States against any attack, to uphold the Monroe Doctrine, and watch over our commerce is essential to the safety and welfare of the American people. To maintain such a navy is the fixed policy of the republican party."



GENERAL VIEW OF CAMPUS, UNIVERSITY OF MAINE.

Alumni Hall, Containing Executive Offices, Drill Hall, and Gymnasium. *Lord Hall, the New Engineering Building.*
Wingate Hall. Civil Engineering, Drawing, and Physics.

MECHANICAL AND MARINE ENGINEERING COURSES AT THE UNIVERSITY OF MAINE.

In 1862, while the nation was enagged in the most bitter struggle in its history, there was enacted by Congress an act which was destined to become the most potent single factor in the educational interests of the country. This was the Land Grant Act, a measure prepared and twice pushed through Congress by the Hon. Justin S. Morrill, of Vermont, and finally signed by President Lincoln, which provided for the granting of public lands for the permanent endowment of colleges in all of the states that would accept the bequest and guarantee to provide the material equipment with which to carry on the work, the chief object being to teach the sciences relating to agriculture and the mechanic arts. As the direct result of this measure there exist to-day in the United States nearly half a hundred universities and colleges, in each of which the sciences above mentioned form an all-important part when not the exclusive feature of the established curriculum. Nearly every state now has its technical school, in which its youth is being instructed in the useful arts, and every

year nearly ten thousand young men are being sent from them into the wealth-producing industries to do their share in the development of the country's resources. In every year that passes there is being manifested by our leading business men an increased confidence in these trained men, and a dependence upon them to furnish the energy and enterprise to bring our industries to the front; and so marked has been our advancement, during recent years, that already English capitalists and educators are studying our educational systems with a view to the improvement of their own.

Maine was one of the earliest states to accept the conditions of the grant, and, in 1868, the institution was opened under the name of the Maine State College of Agriculture and the Mechanic Arts. This name was changed to the University of Maine, in 1897, to correspond with the broader scope of the work that had been decided upon. The policy of the trustees, as upheld by the state, has been to make the university the fitting head of the educational system of the state, in which respect it resembles the great state universities of the west more closely than do the corresponding institutions in other sections of New England. In accordance with this idea the university now includes the College of Liberal Arts, with three distinct courses; the College of Agriculture, with four courses; the College of Technology, with four courses, namely: civil, mechanical and electrical engineering, and technical chemistry; the College of Pharmacy, with two courses; and the College of Law. In the College of Liberal Arts it is possible for the student to specialize in the Greek, Latin, German, or French language, mathematics, civics, history, philosophy, biology, physics, or chemistry, which, with the more closely prescribed courses in the technical and professional schools, allows great freedom in the selection of subjects and gives ample opportunity for every one to find the line of work best suited to his tastes and abilities.

For admission to all courses leading to degrees, excepting in the College of Law, the candidate must offer credits to the extent of 26 points, or their equivalent, one entire year's work of five recitation exercises per week in the preparatory school on a given subject counting two points. Candidates for the College of Technology must include the following: English, 4 points; algebra, 4 points; plane geometry, 2 points; solid geometry, 1 point; one modern language, 4 points; one science, 2 points; history, 2 points. The remaining points may be taken in additional language, mathematics, science, history, or civics. Certificates for the satisfactory completion of this work are accepted from such fitting schools as are approved by the New England College Entrance Certificate Board. Credit is given for work done at other colleges, and students coming from such institutions are given such advanced standing as the work taken entitles them to receive.

Students not candidates for degrees, who wish to take up special work along any line, are allowed to do so on presenting satisfactory evidence that they are fitted to do the work with profit to themselves. Men of experience in engineering work, who desire more thorough grounding in mathematics and the theoretical side of engineering, are welcomed and assisted in every way possible.

The college year of thirty-six weeks is divided into two equal portions or semesters. A subject in which recitations are held once each week, continued during one semester, counts one term hour. In counting laboratory, shop, and drafting-room work two hours of actual time are counted as one. Five term hours count as one credit, and thirty credits, or 150 term hours, are required for graduation in the engineering courses.

The college year begins on the Thursday nearest September 20, this being September 22 in 1904. Short vacations during the Christmas holidays and at Easter are allowed, which bring commencement early in June, and give a long summer vacation.

In arranging his course of study the student is allowed the greatest possible freedom, the elective system being in use. In the engineering work it is of course necessary that the different subjects be taken up in a fixed order, and every student is also required to take two credits in each of the following subjects: English, modern language, mathematics, and some one science. These conditions practically prescribe the work during the first two years, but during the last two considerable opportunity for selection is afforded.

In the mechanical engineering course an option in marine engineering has been offered during the last two years, giving the student an opportunity to specialize in his steam engineering work on the marine types of machinery and their application to ship propulsion. The work of the course, with the necessary allied subjects, is laid out as follows:

During the first two years the study of mathematics, English, modern language, chemistry, and physics occupies by far the greater portion of the time. During these years, however, nine term hours are completed in general drawing and descriptive goemetry, three term hours in mechanisms, and four in shop practice.

In the third year the engineering work consists of mechanics of engineering, machine design and the steam engine valve gear, electrical machinery, one term hour in mechanical laboratory, and eight term hours in shop practice. During the second semester of this year, work in the marine option begins. Each student lays down the preliminary lines of some type of ship, after which he performs the simpler calculations for displacement and center of buoyancy. The purpose of this is to give him that familiarity with the forms of ships, methods of laying off sections, etc., that the designing marine engineer should possess.

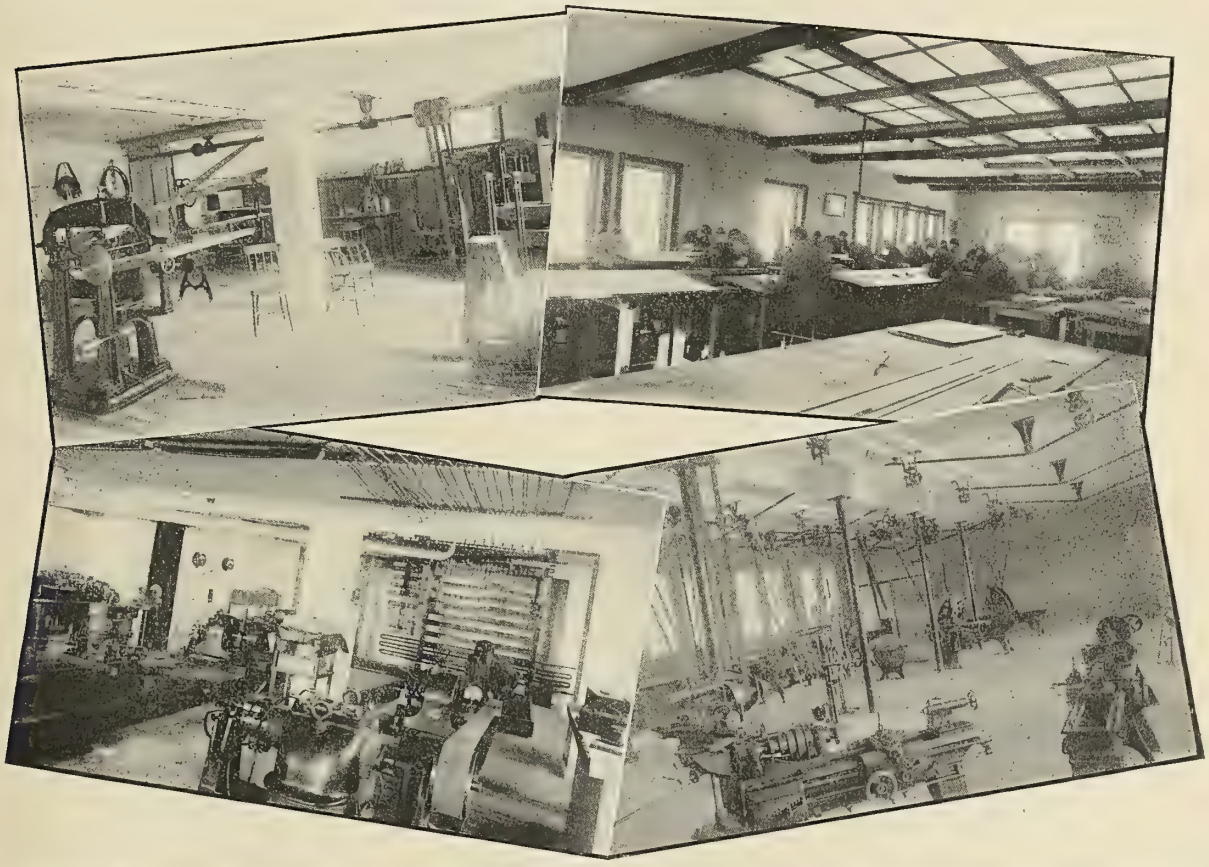
The fourth year's work in the regular mechanical engineering course includes thirteen term hours in steam engineering, of which about one-half is devoted to drafting-room work on boilers and engines, two term hours on materials of engineering, three in mechanical laboratory, two each in hydraulic machinery and in building construction, and three is allowed for thesis work, although that amount is usually exceeded. The work of the marine option differs from this in substituting marine for hydraulic machinery, and ship propulsion for building construction, while the designs of steam machinery are taken for theses, thus increasing the time devoted to steam engineering. Existing types of marine boilers and engines are carefully studied, and working drawings made for a Scotch return tubular boiler and for some type of multiple expansion engine.

A model of the Stephenson link is used in the design of the valve gear. In ship propulsion especial attention is given to power calculations by the law of comparison, and to propeller design by the most approved methods.

Careful attention is given to current engineering literature and to library work generally, and frequent meetings are held for discussion of topics of interest arising in this way. It is believed that the formation of reading habits and the arousing of an interest in subjects of general importance are among the most valuable features of a college course.

At present particular attention is being given to the development of mechanical laboratory work, for which, in the past, facilities have been lacking. A new building for the use of the departments of mechanical and electrical engineering has recently been erected, and is now being equipped. Accompanying cuts show this building in exterior and interior views. The first floor and half of the basement in the front portion, which is 56 by 82 feet, is to be devoted to laboratory purposes, one-half of the first floor for electrical work, and the remainder for mechanical and hydraulic work. On the second floor are the offices, recitation room, and a large drafting room for the two departments. In the rear wing are located the work shops. On the ground floor are the machine shop, 40 by 65 feet; the forge shop, 40 by 31 feet; and the foundry, 40 by 26 feet. Above the machine shop is the wood-working shop. In the machine shop, for which a moderately extensive equipment of first-class machines is already owned, the Hyatt Roller Bearing Company's shaft bearings are to be used in part, and a special feature of the arrangement is to be the adaptability for testing for power losses in transmission and power to drive machine tools. All the machinery is to be motor driven, on the group system, the General Electric Company's motors being used. The B. F. Sturtevant Company, of Boston, is to furnish the new down-draft forges for the forge shop, as also the heating and ventilating system for the entire building.

The mechanical laboratory, on the first floor of the main building, is divided into two rooms, one of which has a solid floor of earth filling covered with a six-inch layer of Portland concrete, and this again by four inches of plank flooring. In this room are to be placed a 60,000-pound Riehlé Brothers standard testing machine, a torsion testing machine, and a friction machine for testing lubricating oils. Room for additional machines in the future is ample. In the second and larger room, which will be the general headquarters for the experimental work and a portion of which will be held for lecture purposes, will be the miscellaneous apparatus for general oil testing, calorimetry, and instrument calibration, and the equipment for belt testing, which is made a special feature of the course. The basement is devoted to hydraulic work, which includes pump and motor testing weir measurements, etc. In the university power station a simple Corliss steam engine, an Otto gasoline engine, and a Heine water-tube boiler are available for



SOME OF THE TESTING MACHINES IN THE OLD LABORATORY.
A PART OF THE OLD ELECTRICAL LABORATORY.

MECHANICAL ENGINEERING DRAFTING ROOM IN WINGATE HALL.
THE NEW MACHINE SHOP, WITH MACHINES PARTIALLY SET UP.

testing under operating conditions. With this equipment, together with the power tests in the machine shop above mentioned, a very valuable training in experimental work, covering three semesters, is given.

During the past year about 540 students have been registered at the university, considerably more than half being in the College of Technology. The marine work has been well patronized, and when the maritime interests of the country are placed on a proper basis, Maine, with her old-time traditions of the sea, will continue to supply trained men for the marine field of work.

The tuition charge is purely nominal in amount, being $30 per annum. Registration, incidental and laboratory fees, text books, etc., bring the regular fixed expenses up to about $100 per year. Living expenses in town and in the dormitory and various fraternity houses range from $4 to $5.50 per week. Few institutions in the country offering equal advantages can be found at which the expenses are as low as this.

The university is delightfully located in the town of Orono, on a branch of the Penobscot river, nine miles above the head of navigation. Both steam and electric railroads connect with the cities of Bangor and Oldtown, distant nine and four miles respectively. The campus, possessing many natural advantages, has been carefully and systematically improved until now it is one of the most beautiful of college grounds in the country. The buildings are plain but substantial and serviceable, additions being constantly made necessary by the rapidly growing student body. The climate is healthful and invigorating, and some of the best of Maine's wild and rugged scenery, and the hunting and fishing for which the state is famous, is within a few hours' ride of the university campus.

THE POSITION OF THE FIREMAN.

BY ROBERT S. RILEY.

We have all had our troubles with the fireman. The average engineer is pretty sure to be anticipating something unpleasant as he draws on his overalls for his first interview with the gang awaiting him below. Leaving port he is not surprised to find them half drunk and altogether unruly. The fires are not properly worked; there is confusion and trouble and ugly looks and words in the fire room. The second assistant, or whoever is in charge, has his hands full, and often resorts to words and tactics that are not becoming to an officer. He literally "puts on his fighting clothes" when he goes below. It looks for a time as if things were hopelessly mixed. Dodging slice bars, shovels, coal barrows, ashes, etc., makes the engineer wish himself "back on the farm again." Very likely, too, a gauge glass bursts about this time, or a blower engine runs hot, or a feed pump sticks. Life seems nothing but troubles for a while after getting under way. But no trouble is more annoying and serious than the friction and heat developed between the engineer and his unruly subordinates.

You really cannot do much with a fireman who cannot or will not fire. Generally it is impossible to watch them all, and you get no satisfaction until they get down to a sea-going basis. "You can lead a horse to water but you cannot make him drink" applies surely to the crowd that you get down in the fire room for the purpose of transforming coal into steam. Efficient firing calls for good-will first of all. For you can get nothing out of the most expert shovel handlers if they are indifferent or against you. Up on deck the officer or boatswain can see everything a watch of sailors does. The coiling of a rope, or the lashing of loose gear shows at once how it was done and all about it. Down below the fireman's work is not visible or subject to analysis after it is done. The sailor of the surly or unwilling type can do but little harm anyway, whereas, the fireman has the sped of the ship almost absolutely under his control. The engiher may hustle all he pleases in the engine room to keep things going at their best, but first of all he must have steam, and for this he looks to the fireman, not so much for his brute strength and endurance, though these he must have, as for his skill in building a hot fire. All sea-going engineers know what a difference it makes which watch of firemen is below, and often it is not the strongest men physically who make the best impression on the revolution counter. The writer has seen many cases where the light, brainy little men can keep the safety valves lifting where the big, powerful ones struggle in vain to get the pressure up. It certainly requires skill to burn coal to advantage.

Whenever a notable run is made we hear plenty about the "gallant captain" and his officers. Some times the chief engineer gets a little recognition, too, but how often do we hear any mention of the latter's subordinates, the men who really make the run? The engineer in charge of the watch is the man responsible for the record of his four hours, and he knows pretty well where to go when a special effort is required. Other things being equal, it is to the firemen of his watch that he looks for the maximum revolutions of his engines. The speed of the ship, then, depends entirely on the ability of the men who build the fires in her furnaces. The economy of the ship in the consumption of the owner's coal is, in the same way, dependent upon the efficiency with which it is burned.

The importance of the fireman is being shown up more and more with the advancement of steam engineering both in the merchant marine and in the navy. Our war with Spain brought it out most clearly during the blockade off Santiago, and the brilliant victory that ended it. To engineers and others conversant with the conditions of that blockade and chase, it must appear that it was something of a "fireman's fight," rather than simply a "captain's fight," as it has been called. The engineer's staff in general kept the machinery ready, but when the thing really happened it was up to the firemen to catch the Spaniards, and they did it.

Firemen, as a rule, are not a bad lot of fellows when at sea. There is a spirit of loyalty and rivalry about them that is quite exhilerating. It is the time-honored custom to rave more or less over the jolly sailor, what a fine fellow "Jack" is, etc. But one who has served with all sorts of crews finds that the firemen are better ship mates in almost every way than the sailors. Of course, there are exceptions, but for eye servants and chronic growlers please deliver us from the average sailor before the mast. Watch him cleaning around the deck and you will generally see that his only object is to pass the time until eight bells; then he drops into his bunk without many preliminaries such as washing. He cannot spare time, for one thing, for he is generally

"four on and four off" with a dog watch in the evening. For the fireman on watch there is no such thing as eye service. His business is to keep the seam-gauge finger over the right mark, and he knows it. The man who does this most easily is generally the best man. The quicker he slices, cleans, and fires, the more time he has to take it easy, and the efficiency of his service generally increases with his speed, while the amount of coal to be shovelled will decrease in like ratio. To the engineer there is nothing smarter or more impressive than a good watch of firemen at work.

The introduction of the water-tube boilers calls for still greater skill in firing, and so does the manipulation of oil fuel. In every way the fireman's responsibility is being increased and his skill and efficiency become of more and more importance to the ship owners. We have no grudge against the ordinary sailor, yet it must be admitted that his importance becomes less with the increase of machinery and its appliances; on a steamship he is hardly more than an ordinary laborer.

Now, if the fireman's good will and skill are such important factors in the engine-room efficiency, why is not more done to attract and keep the right kind of men? They are too important to be neglected. Consider the life of the average sea-going fireman. His sleeping quarters are located almost any place that is not useful for anything else. Ventilation is about the last thing that worries the owner or the naval architect. He sleeps on one of a series of shelves that look about as inviting as an opium den without the opium. His bedding, or lack of it, makes one envious of the nice blankets most horses have. But the most degrading feature of all is the manner of his feeding. Very often the food itself is clean and well enough cooked—not too often, however—but it is nearly always spoiled in the serving, if we dignify such a "hand out" by that name. Because a man is employed at an occupation involving as much dirt as firing, it does not follow that he cannot appreciate civilized treatment when off watch. Indeed, the only way to make a man self-respecting is to treat him with respect. To give a man his food in a trough is very likely to develop the grunt in his nature.

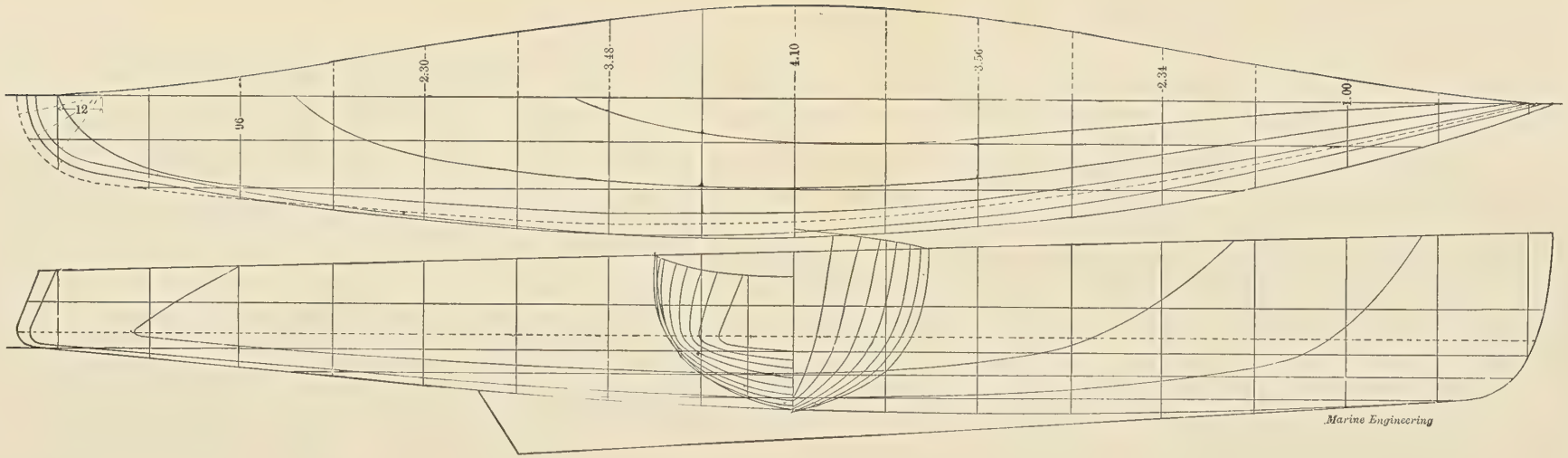
The fire room, generally, is not so bad as pictured. Indeed, many fire rooms are more comfortable than the engine rooms. Some of them are hot, but the ventilation is the best possible. Forced draft may be disagreeable on some ships but natural-draft fire rooms are often pleasant places. The air is good even if the fires are hot, and most of the four hours is not especially trying. Of course, when it comes to cleaning fires and handling ashes, there is more or less hard labor and exhausting work, but even this is not distasteful to a good, active man. There are only four hours of it, anyway. Eight bells comes shortly, and there are eight hours off. A good wash is the first thing, and this is where the fireman excels the sailor in every case. Whoever saw a watch of sailors take a good scrub as firemen do? It is true that they do not get as dirty so far as visible dirt is concerned, but the fireman more than makes up for his dirtier work by the cleanliness of his body when off watch. Most sea-going men agree that firemen are remarkably clean as to their persons. This is probably at variance with popular conception, but true never the less.

But what sort of a place has the fireman in which to spend his eight hours off watch? Usually a dirty, ill-ventilated hole that one does not care to enter or know too much about. It shows a lack of appreciation in the owners and naval architects that they should allot such quarters to men of whom so much is required. A reform is badly needed in this direction. Once the quarters are made respectable and the other living conditions given a better tone, it will not be long before a better class of men will be signed on, and they will not look upon their occupation, as so many sea-going firemen do now, simply as a last resort after all their money is spent ashore. There are a few foreign lines now in existence where the firemen are a thoroughly respectable class of men. The occupation is an honorable one and the pay is better than a similar one ashore, for there are no living expenses.

The chance of a pleasant life among firemen is strongly brought out by the Asiatic crews that one sees in the far East. The Chinese crews in particular have a way of making their forecastle a pleasant home. A Chinese "No. 1" fireman is something of a personage aboard ship. He has absolute control of the men and picks them carefully. They carry their own cook and servants. The quarters are kept scruptuously clean. The food is served in the most approved fashion of their caste. They maintain a dignity and self-respect that gives them a very comfortable and honorable position on board the ship. It is also a permanent one. The Chinamen in this business are highly respected, and this is simply because they have shown themselves worthy of it. Now, why should not our white firemen take a lesson from this? It is true that we expect a higher standard of living from them than from the Chinese. This is granted. We give them more money. But do we give them the other treatment that should go with it?

White men of the class we want do not live in the manner that they are obliged to as firemen on board ship. The firemen's bath room should be convenient and well equipped for its important service in the comfort and cleanliness of the men. The sleeping quarters should be airy and well ventilated, no more than three or four men being put in the same room. Above all the sleeping quarters should be for sleeping only, and no food should be eaten there. A proper mess room should be provided with gear enough to give them a service suitable to their station in life. For their leisure hours, both at sea and in port, they should have the freedom of a suitable room or compartment where they could spend the time decently. Surely they deserve as good or better than the steerage passengers. Our modern ships now make it very comfortable and pleasant for the latter. Why should not their skillful and tried firemen be worthy of the same improvement in their living conditions? Here lies a great need for improvement and one that would repay the expenditure necessary. The efficiency of the firemen is of great importance to the owner of ships, and he would do well to invite a better class of men than is attracted by the present conditions.

Marine Disasters for May.—The administration of the Bureau Veritas reports that during the month of May there were lost from the combined merchant marines from various accidents, such as stranding, collision, fire, condemned, etc., 66 sailing vessels and 40 steamers.



LINES OF 32-FOOT SPEED LAUNCH ADJIDAUMO.

Thirty-two-Foot Speed Launch Adjidaumo.

Hale House, one of Boston's social settlements, has a camp for boys on Lake Asquam, N. H., adjoining the summer home of the president, Mr. H. B. Sawyer. From the nearest railroad station at Ashland the water route leads through a narrow and tortuous river into the lower lake, thence to and through another river and the full length of the upper lake, a distance altogether of thirteen miles. Mr. Sawyer's business in Boston makes him dependent on trains, and he found the regular steamer service, with its numerous stops, took up too much of his time.

Accordingly the launch *Adjidaumo* was designed to meet the following requirements: Speed not less than twelve miles an hour, construction specially strong, because of the danger of running on submerged rocks; a quick helm, to take sharp bends, and equipment such as to be easily handled by one man. The boat was, moreover, to be at the disposal of the camp, and must, therefore, be able to carry a dozen or more people with comfort, and stiff enough so that all of them on one side should not endanger a capsize. The dimensions and

MARINE ENGINEERING DATA CARD. **AUGUST, 1904.**

NAME—Adjidaumo. NATIONALITY—American. TYPE—Motor launch.

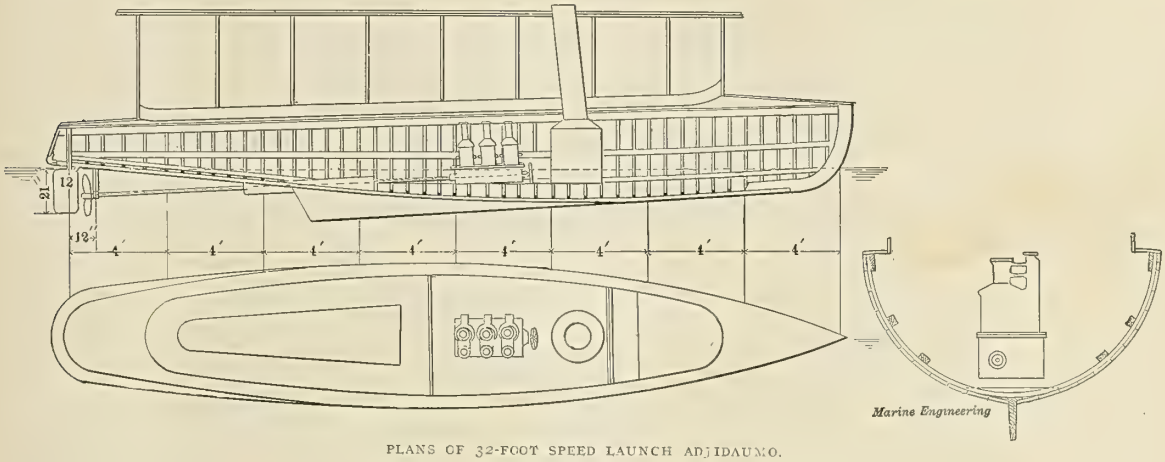
LAUNCHED—1903. DESIGNER—Edmund B. Edwards. OWNER—H.B. Sawyer.

Length over all	33 ft 5 ins.
" water line	32 " 0 "
Beam, extreme	6 " 0 "
" water line	5 " 0 "
Draft, to rabbet	0 " 16 "
" extreme	2 " 3 "
Freeboard, forward	2 " 8 "
" midship	2 " 2 "
" aft	1 " 8 "
Displacement, loaded	4,350 lbs.
Scantlings: keel, white oak,	sided, 6 ins.; molded, 2 ins.
Stem, white oak	sided, 2 "
Plank, cedar	3-4 "
Garboard and sheer strake	oak
Skag, oak,	sided at top, 2 ins.; bottom, 1 in.
Frames, white oak, sided, 1 1-4 ins.;	molded, 7-8 in.; spaced, 8 ins.
Floors, oak, sided 1 in.; molded, 2 ins. in throat	
Clamp, hard pine	1 by 4 ins.
Bilge stringers, 4 hard pine	1 1-2 by 2 1-2 "
Deck, white pine	7-8 in.
Fastenings	copper-riveted over burrs
Engine:	Buffalo, four-cylinder
Builders rating	14 H. P.
Cylinder diameter	4 1-2 ins.
Stroke	5 "
Crank shaft, diameter	1 1-2 "
Floor space	21 1-2 ins. length by 9 3-4 "
Fly wheel, diameter	18 "
R. P. M., in service	450
Weight, engine	565 lbs.
" reversible gear	150 "

scantlings are given in the data card. A steam engine of original design and a coil boiler with oil burner were first installed, but these were removed, principally as it was found that the attention of an extra man was required. This is the power shown in the cut. A gasoline engine was later substituted.

The engine is a 14 horse power Buffalo motor, and the coarse pitched propeller, designed for the steam engine, keeps the revolutions down to about 450, so that the actual power is not far from 10 horse. With this power *Adjidaumo* makes better than 12 miles, beating all the steamers on the lake, and running the thirteen miles, including run through shallow water and sharp turns, in an hour and three minutes. With her steam rig her speed was about 15 miles. She will turn in a circle of 70 feet diameter, is very stiff and is dry in the short chop of the lake.

The *Adjidaumo* was designed by Mr. Edmund B. Edwards.



PLANS OF 32-FOOT SPEED LAUNCH ADJIDAUMO.

Navy Engineering Laboratory.—A civilian architect has been called in consultation in the preparation of the plans for the experimental laboratory for naval engineering at the Naval Academy. Little has been accomplished in the last year, although an appropriation for such an establishment was made by congress some time ago. To an officer, Lieutenant Commander Walter F. Worthington, of the Bureau of Steam Engineering, has been assigned the duty of developing the project. The establishment will not only be devoted to work of interest to the service, but will conduct experiments and make tests of apparatus offered to the navy by industrial concerns. The present facilities in this respect are limited, and are confined to what may be spared from the contingent fund, from the Bureau of Steam Engineering, and from the means of experiment at the larger navy yards. Naturally, the opportunities for doing work of this kind are not extensive. When the laboratory is in operation at Annapolis it is intended that investigations of great importance shall be conducted. Institutions of a similar character abroad have been examined by our naval attachés, who have made reports in regard to them, and it is intended to apply the latest and best devices to the Annapolis establishment.

Merchant Marine Commission.

The sessions of the Merchant Marine Commission were resumed in Chicago the last of June and following meetings were held in Detroit and Cleveland. Much interesting testimony was submitted before the commission at these cities by men prominent in marine lines. The commission has been hospitably entertained by the boards of trade of these three cities and its work has aroused general interest.

The testimony at Cleveland of Mr. J. C. Wallace and of Captain A. B. Wolvin, were doubtless the most important given on this western trip. Mr. Wallace, vice-president and general manager of the American Shipbuilding Company, said that he firmly believed that the time had arrived when measures should be taken for protecting ships in the foreign trade. The general condition on the Great Lakes was satisfactory as all had been done for the ships that could be done.

He declared, however, that, in his opinion, subsidy would not benefit the American shipbuilders, and proceded to give his reasons therefor. He stated that 100,000 tons of steel had been sold at Belfast at $24 per ton, which would be $22 at tidewater, as against $32 Pittsburg charged to American shipbuilders. In a vessel consuming 6,000 tons of steel this would mean $50,000. Concerning the cost of shipbuilding and the employment of skilled labor at home and abroad, he stated that the American workman had the advantage of better machinery, and mentioned especially the fact that pneumatic tools are in far more general use in the ship yards of this country than they are abroad.

In reply to a question, Mr. Wallace stated that Harland & Wolff were the purchasers and the United States Steel Corporation sellers of this order. Continuing, he stated that from his experience in the lake trade, cost of American-built ship was 40 per cent. more than the English-built ship.

Mr. Wolvin submitted figures concerning the operation of the Swedish vessels in his line, the Great Lakes and St. Lawrence Transportation Company. The cost of operating the Swedish steamers is fully 40 per cent. less than the cost of operating the American vessels of similar tonnage in the same company.

Hudson River Steamer Mary Powell.

Of all the river steamers plying from the port of New York, none is so well known or so general a favorite as the side-wheel passenger steamer *Mary Powell,* known for many years past, and rightly so, as "Queen of the Hudson." The original wooden hull was built by the then well-known shipbuilder, M. Allison, of Jersey City, the keel being laid in the year 1861, and the vessel completed in the year following, the engines and boilers being built and installed by the firm of Harrison & Fletcher (now W. & A. Fletcher), of North River, N. Y.

The building, launching, and early life of the *Mary Powell* were themes of unfailing public interest, for she was considered a big boat in her day, and one of the finest examples of American naval architecture, pictures and descriptions appearing in the leading magazines of the old and new worlds. Since those early days many repairs and renewals have been made to the hull and machinery, so that now it would be a difficult matter to find a piece of wood or metal which lent strength or beauty to her when launched, but the lines have been so carefully preserved that there has been no deviation from her original construction. We find in the records of the Supervising Board of Steamship Inspectors that the wood hull was entirely rebuilt by the New Jersey Dry-Dock Company, Elizabeth, in the year 1897, new steel boilers having been built and installed six years previously by the firm of McEntree & Rodie, of Rondout. These two boilers were of the tubular type, 27 feet in length, 10 feet 8 inches diameter of shell, 11 feet 6 inches width of front, and allowed a working pressure of 45 pounds reduced latterly to 38 pounds per square inch.

In talking of the speed of the *Mary Powell,* the owners say that in the year 1881 she made her record run between New York and Roundout, with eight landings, in 4 hours and 12 minutes, a distance of 100 miles.

This winter the boat has laid at the yard of the Townsend-Downey Shipbuilding Company, Shooter Island, N. Y., undergoing extensive repairs to her machinery, having new steel boilers built and installed, new smoke stacks and steam pipes, and new paddle wheels of the fixed bucket type, of slightly less diameter, substituted for the old of the same type, 33 feet outside diameter.

Looking at the accompanying photographs it will be seen that the paddle wheels are well forward and boilers are placed on the guards just abaft the paddle boxes. This position was quite usual in the days when this boat was built, and one which did away with the heartburnings of present-day designers when arranging passenger accommodation, but it is now seldom seen, being prohibited on later-built vessels by the Board of Supervising Inspectors. This winging out of the weights of boilers accounts for the stability of the *Mary Powell* although possessing such an exceeding fine hull. Owing to this fineness of hull, unusual care had to be taken by the Townsend-Downey Company in lowering the new boilers, which weighed, when shipped, about 25 tons apiece, that both boilers should rest in their saddles at the same time. The job, however, was successfully done, and the boilers shipped with barely a movement in the boat other than changing the draft.

In many ways the career of this vessel has been unique, in that she was built to the order of Captain A. L. Anderson, father of her present captain, and was owned entirely by that family up to a few years ago, when the controlling interest passed to the Hudson River Day line, but Captain A. E. Anderson, who relieved his father some thirty years ago, is still in command. She is also what is known as a lucky ship, in that during her whole career she has had no accident which entailed injury to either her passengers or crew; in fact, the only accident on record is one that happened some four years back, when both her smoke stacks were carried away during a summer squall off Peekskill, and in which the captain tells with pride how they continued the trip, making all landings on time.

THE FAMOUS HUDSON RIVER STEAMER MARY POWELL.

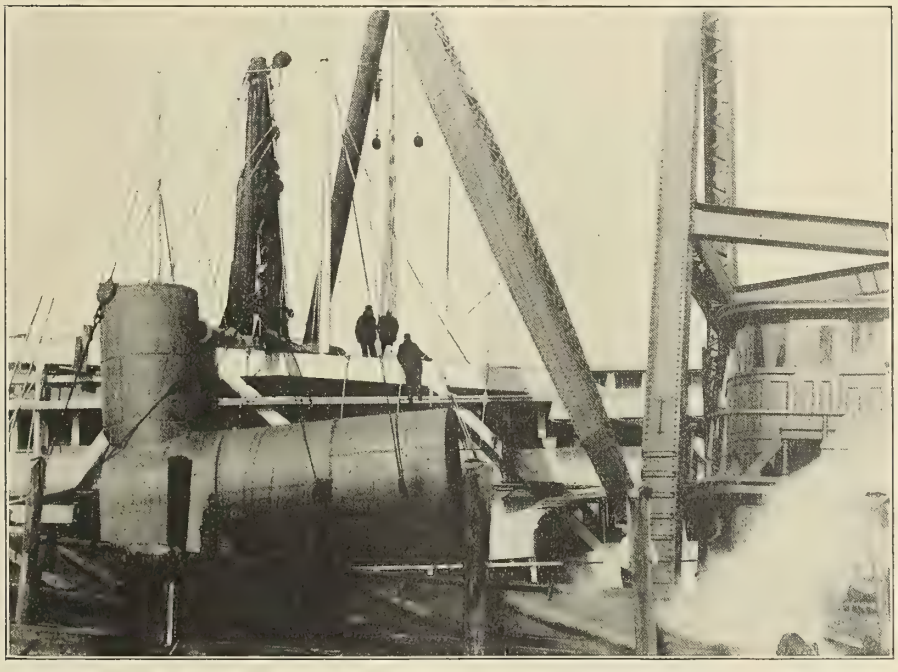
Particulars of the *Mary Powell,* as she now stands, are as follows:

Length, over all	300 ft. 0 ins.
Length, between perps	286 ft. 0 ins.
Length, on load-water line	288 ft. 9 ins.
Beam molded	34 ft. 4 ins.
Beam, over guards	64 ft. 0 ins.
Draft, mean	6 ft. 0 ins.
Displacement, about	800 tons
Midship section	170.5 sq. ft.
Block coeff	.494
Gross registered tonnage	983 tons
Number of passengers	1,700

Engines. Type, standard condensing beam engine.
Cylinder diameter ..... 72 ins.
Stroke ..... 12 ft.
Indicated horse power..... 1,560
Revolutions 27

Boilers. Number and type.....2 tubular
Length ..... 27 ft. 0 ins.
Width of front..... 11 ft. 6 ins.
Diameter ..... 10 ft. 8 ins.
Tubes ..... 80, 5-in. tubes, 19 ft. long

THE FAST RIVER STEAMER MARY POWELL, FITTED WITH NEW BOILERS.



SETTING THE NEW BOILERS IN PLACE ON THE STEAMER MARY POWELL.

Paddle Wheels. Fixed floats. Wood.
Outside diameter ..... 31 ft. 9 ins.
Number of floats (buckets)..... 26
Width of float..... 10 ft. 6 ins.
Face area of floats..... 15 1-2 sq. ft.

Flues, one boiler.....2, 18 ins. dia.; 4, 16 ins.; 2, 15 ins.; 2, 12 ins.; all 10 ft. 10 in. long.
Working pressure ..... 45 lbs.
G. S., two boilers..... 156 sq. ft.
H. S., two boilers.....5,664 sq. ft.

Westward Run of the Oil Burning Steamship Nebraskan.

On June 10, the steamship *Nebraskan,* of the American-Hawaiian Steamship Company, arrived in San Francisco from New York, after a successful voyage, burning oil as fuel. A supply of Texas residuum oil taken on board at New York, lasted for the complete voyage. In the May issue the eastward passage of this ship, burning Bakersfield oil, was described. A comparison of the two trips may be made from the following summary of the westward passage and the eastward passage, as given on page 208 of the May issue.

	DAYS.	HRS.	MIN.
Time of voyage	54	6	42
Steaming time	52	11	27
Stoppage at sea		4	11
Detention in Strait of Magellan	1	15	4
Distance covered, nautical miles			13,135
Draft, mean, leaving			25 ft. 6. ins.
Draft, mean, arriving			22 ft.
Displacement, mean, for trip			8,576 tons
R. P. M.			73.39
I. H. P., main engines			2,010
I. H. P., total			2,220
Average speed, knots			10.43
Slip of propellers, per cent			15.2
Ship docked previous to leaving.			
Oil, Texas residuum, 22½B. at 60° F., total bbl.			9,687.7
Barrels of oil per hour			7.69
Pounds of oil per I. H. P. per hour			1.12
Miles per barrel of oil			1.36
Air pressure at fan			.8 to .9 ins.
Air pressure at blowers			1.25 lbs.
Temperature of oil in heater			90 deg. F.
Temperature at base of stack			430 to 450 deg. F.

So successful has been the performance of this ship that two other vessels of this company, the *Alaskan* and *Arizonan,* are to be fitted with Lässoe-Lovekin oil burners, similar to those on the *Nebraskan.*

Erratum:—In the data card on page 208, May issue, oil bunker capacity should be 10,500 barrels instead of 1,200 barrels.

Annual Shipbuilding Returns.—The Bureau of Navigation reports 1,092 sail and steam vessels of 349,573 gross tons built in the United States and officially numbered during the year ended June 30, 1904. Of this total 55,177 tons were wooden sailing vessels, most of which were built on the Atlantic and Gulf; 39,891 tons were wooden steam vessels. Of the steel tonnage only 5 vessels of 15,374 tons are sailing ships built on the Atlantic; 47 of 97,981 tons are propelled by steam, built in the same district, and 41 of 139,898 are of the same class. built on the Great lakes. During the corresponding year, ended June 30, 1903, 1,215 sail and steam vessels of 376,502 gross tons were built in the United States and officially numbered. The wooden tonnage built this year is about 12,000 tons greater than last year, most of the increase being on the western rivers. There has been a falling off of the steel tonnage on the Atlantic, but an increase on the Great lakes. The unrigged vessels for 1904 number 216 of 51,844 tons, and for 1903 320 vessels of 79,574 tons.

Austrian Cranes.

BY FRANK C. PERKINS.

The illustrations on the opposite page show two most interesting types of cranes recently installed at Triest by J. von Petravic & Company, of Wien-Hernals, Austria. The pontoon crane has a capacity of 30 tons, raised at the end of the beam, which projects 46 feet beyond the float, and is operated by steam power. The height is 73 feet over all. It was constructed for the Arsenal der Dampfschifffarts-Gesellschaft des Oesterreichischen Lloyd, and for the "Stabilimento tecnico Triestino."

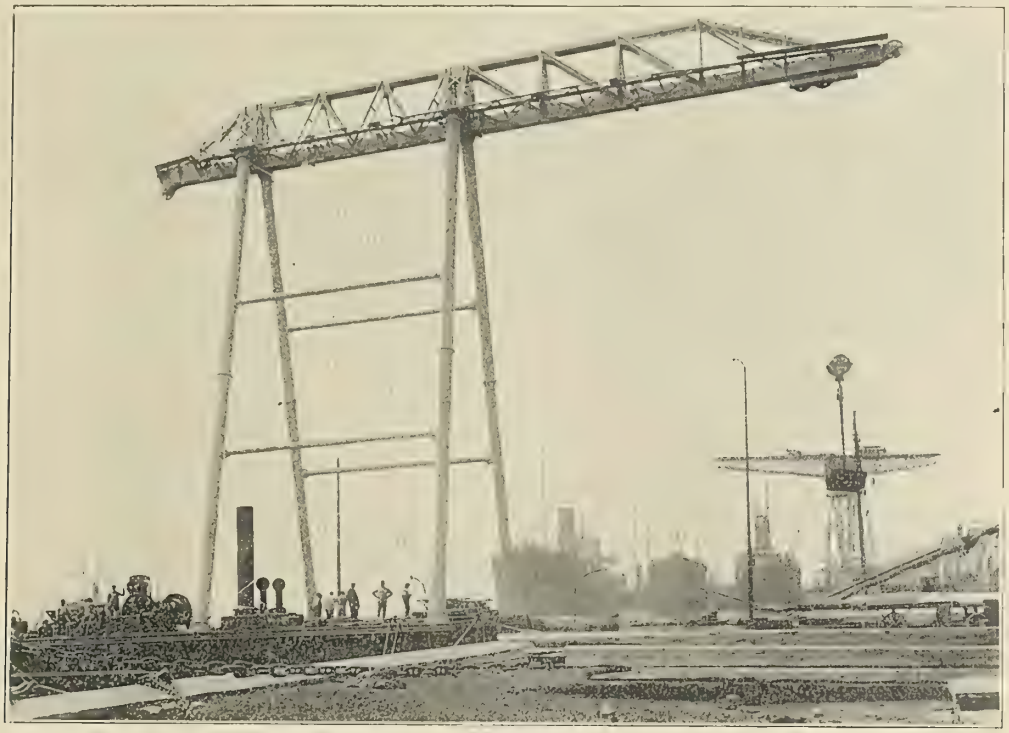
The wharf crane, shown at bottom of page, is operated by electric power and was constructed for the Steam Navigation Company of the Austrian Lloyd at Trieste. The work of this crane is to place or remove complete sets of marine engines and boilers of ocean liners and battleships in the shortest possible time, and also to handle at high speed the lighter weights for the general loading. This last duty is of the greatest importance because as a rule cranes built for heavy work will work with a low efficiency and too slowly when used for lighter service, which frequently forms the greater part of the work carried on at any ordinary wharf. Therefore, the adaptability of this crane to all kinds of work, makes it unique. The total height of the crane is 112 feet and it has a maximum projection of 66 feet at the short jib with a load of 35 to 170 tons, and a maximum projection of 100 feet at the long jib for loads up to 35 tons. The maximum load of the big trolley and short jib of this wharf crane is 170 tons, while the maximum load of the small trolley and long jib is 50 tons.

The small trolley has a lifting speed of 100 feet per minute and a traveling speed of 65 feet per minute, while the big trolley has a lifting speed of 1.8 feet per minute and a traveling speed of 27.5 feet per minute, while the slewing speed is one complete revolution in six minutes. All motions are attained by the use of series-wound electric motors and the speeds above referred to are for maximum loads, while with smaller loads the speeds will be proportionately faster.

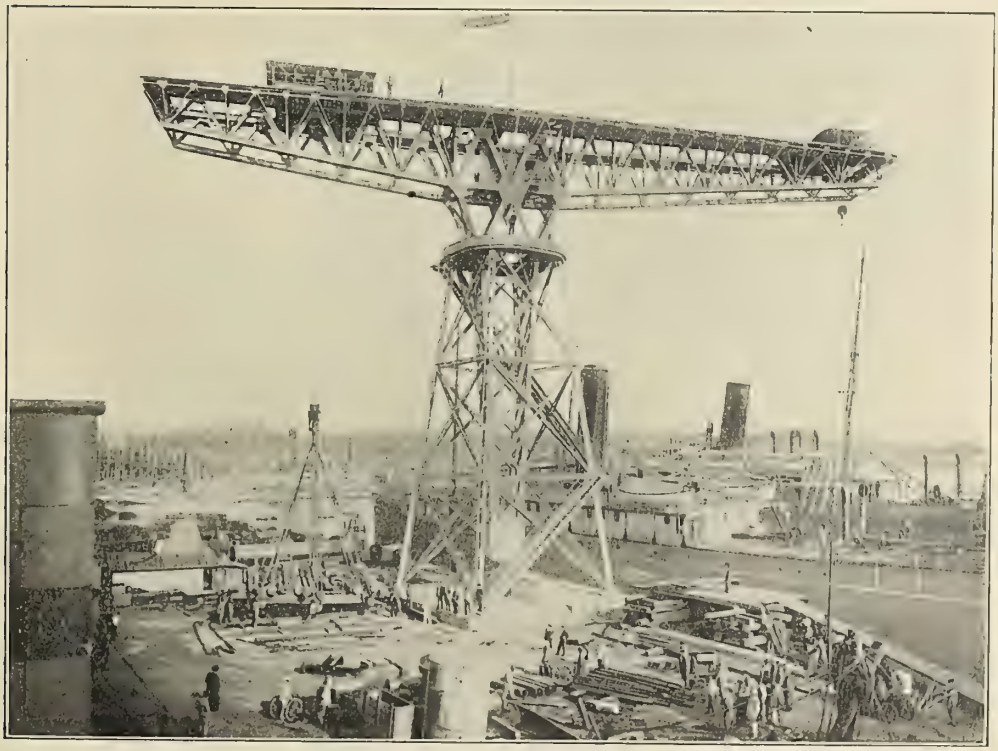
The crane is operated from a place well protected against the weather, the electric installation being such that the crane is always under the most perfect control. The whole crane is provided with automatic lubrication.

The wind pressure is said to be reduced to a minimum as the crane will automatically work like a weather cock. A large crab is erected on the short jib for heavy loads only with weights up to 300,000 pounds, while on the long jib a smaller crab is erected for lighter loads up to 70,000 pounds, operating at the various speeds above mentioned. As a counter weight when heavy loads are being raised by the large crab a ballast car has been constructed to act along with the small crab, but when light loads are being raised the great crab itself is sufficient to act as a counter weight. A most ingenious arrangement has been adopted to enable the crane to work automatically, independently of the crane man. The large crab cannot lift loads unless the small crab together with the ballast car has reached the further end of the jib, and similarly the small crab cannot lift loads unless the large crab has obtained the utmost end of the jib and the ballast car rests above the center pin of the crane. The stress on the crane post and power to operate traveling motion, are reduced to a minimum.

Monthly Shipbuilding Returns.—The Bureau of Navigation reports 137 vessels of 51,607 gross tons built in the United States and officially numbered during the month of June. The largest steel steam vessels included in these figures are the *Minnesota,* 20,718 gross tons, built at New London, Conn.; *Sahara,* 5,785 gross tons, Lorain, Ohio; *City of Atlanta,* 5,433 gross tons, Chester, Pa.; *Martin Mallen,* 4,635 gross tons, Cleveland, Ohio.



PONTOON CRANE.



WHARF CRANE AT TRIEST, AUSTRIA.

Marine Engineering

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Notice to Advertisers.

Changes to be made in copy, or in orders for advertisements, must be in our hands not later than the 15th of the month, to insure the carrying out of such instructions in the issue of the month following.

THE steam turbine, for marine propulsion, still continues to hold the center of the stage in point of interest for the marine engineer. This is shown by the recent output of literature on the subject, as well as by the reports of actual progress which the turbine is making in present-day and prospective designs. The most notable feature of recent progress is the report of the Cunard Commission in favor of the turbine for the new ships projected by that company, and the entry of this type of prime mover in this manner at one jump into the very front rank of marine practice. The general advantages claimed for the turbine are now too widely known to call for mention here, and our present purpose is rather to call attention to one or two special features suggested by the synopsis of the report which has been made public.

To the great surprise of all engineers the commission report that the saving of weight to be anticipated by the adoption of turbine machinery is only some 300 tons, an amount so inconsiderable in comparison with the total as to remove the saving of weight from among the advantages which might be expected from the turbine outfit. Such an amount is, in fact, so small, that but slight changes in the design might wipe it out entirely or throw the balance in the other direction. The same general conclusion seems also to be reached with regard to space occupied, especially in terms of fore-and-aft length of engine room. The commission in fact recommends that the 300 tons margin in weight be held in reserve for machinery design and not added to cargo capacity or absorbed for other purposes. These results are distinctly disappointing, particularly as regards the negligible saving of weight with turbine machinery, especially as in the smaller installations of torpedo-boat size, as well as on the Clyde and English channel steamers there seems evidence of a considerable saving in weight as compared with reciprocating engines of the same power and of type suited to the same general purpose. Engineers will therefore await with keen interest some further information regarding the basis on which these estimates of weight were made, and how it is that the saving which seems to be demonstrable with a relatively small installation of 2,000 to 6,000 I. H. P. disappears with an installation of 75,000 I. H. P. Regarding this matter of weight two points may be noted: First, the turbines contemplated in the design are of the Parsons type, and these are especially exacting in point of length occupied. It may well be therefore that in point of weight they are somewhat heavier than some of the other designs of multiple effect turbine, such as the Curtis or Rateau, though naturally data are lacking for any accurate comparison. Second, even though this were true, it does not explain the apparent loss of a weight saving which smaller installations of the Parsons type seem to have demonstrated. It must be remembered, however, that the installations on which such saving seems to have been shown are small and of relatively high revolution types, for the most part from 600 to 1,200 r. p. m. The proposed revolutions for the Cunarders are 140, chosen, doubtless, as a compromise figure between the requirements for best results with the turbine and those for best results with the propeller. Under these circumstances and dealing with units of about 18,000 I. H. P. size, it may well be that a saving of weight which is real in the field of torpedo-boat practice disappears in the case of the transatlantic liner.

When we remember, however, the relatively

rapid spring of the turbine into prominence, the few years of experience with it as a prime mover, and the small effort which has thus far been expended in any serious attempts looking toward a saving of weight, we may confidently look for the future to produce such improvements in design and structural detail as shall serve at least to reduce very materially the weight figures which prevail in present turbine practice.

Another point of great importance has been above referred to in connection with the combined economy of the turbine and propeller. It must never be forgotten that the final measure of propulsive efficiency is the power which is usefully applied in the propulsion of the ship, and that this will depend on the propeller as well as on the turbine. Of these two items neither must be sacrificed to the other, but some compromise must be effected in which each shall have fair representation. It will usually result that the best conditions for both cannot be fulfilled simultaneously, and that a compromise is therefore called for. In particular, designers of turbine machinery must realize the important fact that the efficiency of a turbine operating under the most economic conditions possible may be entirely wasted and rendered of no avail by an inefficient propeller.

Another item of importance in connection with the report of the Cunard Commission is in the recommendation for Scotch boilers, presumably without superheaters. The recommendation of Scotch boilers was presumably dictated by two considerations: (1) conservatism regarding use of water-tube boilers on a transatlantic liner, and a natural tendency to stand by the type which has served so long and so well in this field until the advantages of the water-tube type for such service shall be more clearly demonstrated than at present; (2) smaller need for high steam pressure with the turbine than with the reciprocating engine. Curiously enough the latter seems to respond more readily as regards gain in efficiency to an eleavtion in the initial temperature and pressure, while the latter responds similarly in more marked degree to a decrease of the final temperature and pressure. Hence we find for the turbine an imperative demand for the lowest possible final pressure and best possible vacuum in the condenser.

Again, while the use of highly superheated steam has been shown to be productive of a pronounced saving in the steam turbine, the omission of superheaters from the design implies a hesitation on the part of the commission to add the necessary weight and complexity which such an outfit would entail. This, however, is an item possibly subject to later revision, and presumably needing, in the opinion of the commission, some further experience in connection with the practicability of superheaters as a feature in present-day marine practice.

The status of the steam turbine as a factor in the field of marine propulsion seems now well assured, and every engineer will do well to keep his eyes and ears open to the trend of practice in the direction of this new type of prime mover.

THE coroner's jury which investigated into the cause of the *Slocum* disaster has held the owners and officers of this vessel guilty of criminal negligence, and censured the inspector for incompetent and indifferent inspection. The federal jury is, at the time of writing, in session, and promises a thorough probing of the matter; and the superficial investigation of the United States local inspectors is at present under way. This accident has been discussed with great detail in the daily papers. Thorough ventilation of the causes and conditions were made, and every citizen is more or less familiar with the fearful disaster whereby 958 lives were lost, more than during the entire Spanish-American war.

Are there any evidences of reform, either in the administration of the laws by the government, or in living up to the spirit of them by the steamboat owner, or is there an overwhelming public demand for adequate protection? We regret that there is little such spirit manifest. The very next day following the disaster another crowded excursion steamer passed the *Slocum* wreck. Steamboat companies do not report any falling off in receipts. It appears, therefore, that while the inflammable construction, absolute disregard to ordinary precautions of safety—such as boat and fire drill on the part of the officers and crew, poor life preservers, and fire-fighting equipment on the part of the owners, and criminally inefficient steamboat inspection under obsolete rules—while all these are immediate causes, the underlying cause appears to be that our public at large is willing to take as great chances in its amusements as in its business. If this be true, neither steamboat company nor government will be awakened to its responsibility.

REPAIRS.

A Sea-Valve Job.

Editor Marine Engineering:

Some years ago, while employed by a well-known dredging company, we had occasion to add a sea valve or river cock, for independent supply to circulating pump. The dredge, a large hydraulic affair having a wooden hull, had been thoroughly overhauled the winter before, at which time the surface condenser and centrifugal pump had been installed. The condensing up to this time had been accomplished by a jet apparatus, but not entirely satisfactory. It was first intended to obtain water from a pipe already in use for supplying main feed pump, injectors, deck pump, etc., but the quantity being more or less irregular lowered the efficiency of the condenser; for that reason we decided to install the independent supply.

After some thought it was proposed to do the work without stopping the regular work of the dredge, and we accomplished the job in the following manner, with a force of three men, machinist, carpenter, and diver.

Having the position located, we first held the velve in place and marked off the bolt holes. Then removing the valve and finding the centers of the bolts we found the center of the opening in the valve, which was 10 inches diameter, and marked off a circle. The carpenter in the meantime had supplied himself with a dozen soft wood plugs, slightly taper, to drive into the bolt holes as soon as he withdrew the bit. With a piece of bent wire we found the exact thickness of the planking at this point, through one of the bolt holes, and by putting a collar over a flat-bottomed bit, the carpenter was able to bore the 10-inch circle full of holes and leave a bottom about half an inch thick. The hole he trimmed out carefully making a smooth job.

By this time the diver was ready for business. It may be mentioned here that the opening was about 4 feet below water line when the dredge was on an even keel, and would vary a foot or more as the dredge rolled. The bolts were 1 inch diameter of Muntz metal, with mushroom heads about 2 inches diameter, the body being a good driving fit in the holes. These bolts, when driven in place by the diver, drove out the wooden plugs without any leakage whatever.

We then made our joint, and bolted the valve in place. The only remaining thing was for the diver to bore a hole from the outside through the half-inch left by the carpenter, and with a small compass saw follow around the 10-inch hole. We then opened the valve to flush out any chips that might lodge on the seat, this being the only water we shipped during the whole operation, although we had taken precautions by having weighted canvass ready for instant use.

Bolting the strainer in place was but a few minutes' work and completed the job, the whole operation taking about 3 hours, and was considerably cheaper than dry-dock or railway. M. U. D.

A Home-made Diving Suit.

From time to time one hears of the ingenuity displayed by the captains and engineers of ocean-going vessels when called upon to make repairs at sea, and the following account, considering the simple methods employed, may be of interest.

When the Norwegian ship *Flora* was on the way to South Africa she sprung a leak, during a heavy gale, and the water rose rapidly in her hold. All hands manned the pumps, which were kept going till calmer weather prevailed, when the skipper, Captain I. Matson, adopted a clever and singular expedient for the preservation of his vessel. First he constructed from sail-cloth a bag 16 feet long, 6 feet in circumference, and 2 feet in diameter, with circular bottom. Between 5 feet and 6 feet from the bottom of the sack, and corresponding to the height of his eyes, he cut a hole and securely inserted therein a piece of glass. On either side of and a little below this window he made two smaller holes, to which he sewed water-proof sleeves made from a pair of overalls. In order to keep the bag open he fixed iron hoops inside at intervals of about 15 inches. When all was ready the skipper got inside the sack—his feet at the bottom, his face opposite the little window, his arms in the sleeves, tied tightly at the wrists—and was swung over the side near the leak. The strange apparatus and its occupant were lowered below the water until, through the window, the shipper discovered the leak, some 3 feet below the surface. The bag was, of course, open at the top, so the captain could see and talk with his men; the carpenter was at the bulwarks to lower necessary tools. Tackle, it should be explained, had been rigged up under the keel, with one block made fast to the bottom of the bag so that the latter could be pulled down over the leak and held in position. The skipper stopped the leak by filling up the hole with rope-yarn and nailing over it some canvass. During the rest of the voyage the ship made only one inch instead of six inches of water an hour. The captain was, at times, owing to the rolling of the vessel, 7 feet below the surface. The chaffing of the bottom of the bag against the ship wore a hole in the canvass; then the captain was pulled on deck, mended the hole, and was lowered again. On arrival at Cape Town he went down again and thoroughly calked the hole. E. C. B.

Standard Wins Challenge Cup.

The series of races held on June 23, 24, and 25 for the gold challenge cup offered by the American Power Boat Association, resulted in three successive victories for the *Standard*. The races were held off the Columbia Yacht club on the Hudson river, and while the entries numbered nine, there were only three competitors, on the first day: the *Standard, F. I. A. T. I.,* and *Water Lily* started; on the second and third days the *Standard* and *Water Lily* alone raced, the *F. I. A. T. I.* having sustained damage to her rudder soon after starting on the first day. The race was over a 16 nautical-mile course and return, and the *Standard's* time for the three days was 1:37.48, 1:33.30, 1:34.21. The average on the second day was 20.53 knots. The race was decided by points and was handicapped according to the rating of each competitor. With time allowances figured in, the *Standard* beat the *Water Lily* 5 minutes and 24 seconds on the first day, 3 minutes and 54 seconds on the second day, and 6 minutes and 51 seconds on the third day. There was general disappointment in the lack of interest or attendance at these races.

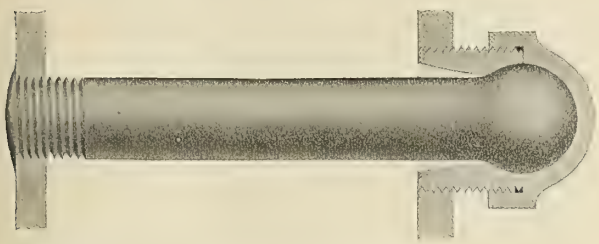
ENGINEERING SPECIALTIES.

Flexible Staybolt.

The delay, labor, and expense occasioned by the breaking of staybolts is appreciated by marine engineers generally, and many devices in the nature of flexible staybolts have been brought out to lessen the liability of breaking, but these have not as yet proved efficient. Lodgment of scale and sediment makes them rigid and some have a further defect of impossibility of inspection. The requisites for an efficient flexible staybolt are that it always remain flexible, allowing movement in every direction; that it may be readily examined; and that it be of full strength. These points are claimed by the Flannery Bolt Company, Pittsburg, Pa., for the Tate flexible staybolt.

This bolt, a cut of which is here shown, consists of three parts: first, the bolt itself, forged out of the best grade of puddling iron, the bushing or sleeve, which is of cold rolled steel, and the cap, which is of steel forging.

The sleeve is threaded on the outside with slightly tapering thread at one end, which is screwed into the outer plate, the remaining portion of the threads being



A NEW FLEXIBLE STAYBOLT.

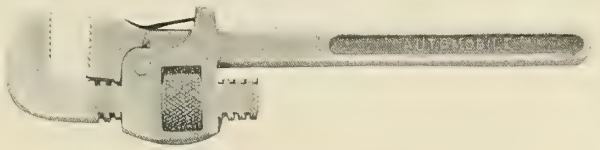
provided to engage the cap. This sleeve is made with a flaring mouth on the water space side, and is finished on the inside of outer portion in half-spherical opening, forming a joint with the half-spherical opening in the cap. The cap is recessed on the inside and threaded, and is also finished in a half-spherical socket opening, which when screwed over the sleeve forms a joint, thus making a perfectly spherical ball socket.

The bolt is manufactured elliptical, but when in working position it forms a perfectly spherical head, which is made to fit the spherical ball socket formed by the union of the sleeve and cap, and only needs threading at the end entering the fire-box sheet. In the installation of the Tate flexible staybolt a concave club is held against the head of the bolt, while the peening of the fire-box end is being done, thus making the head perfectly spherical when in position.

The points claimed by the manufacturer for this bolt are: That the head is spherical, having no plain surfaces or openings to invite the collection of sediment; that the cap is a protection for the head, easily removed for inspecting the bolt; simplicity and installation; increased safety and decreased cost of maintenance. Severe tests have been made of this bolt used on boilers located in bad water districts with very satisfactory results.

Pocket Pipe Wrench.

To meet the demand of motor-boat men and automobilists for a small and handy pipe wrench, the Walworth Manufacturing Company, 138 Federal street, Boston, Mass., has brought out a Stillson wrench, an illustration of which is herewith shown. The wrench is made of the best quality of tool steel, case hardened,



A HANDY STILLSON WRENCH.

and can stand the severest and hardest kind of usage. The serrated tempered jaws are 3-4 inch deep and open a full inch. The yoke is held in place by a pin and by a tempered steel spring. The length of the handle from jaw opening to end is 6 inches.

Efficient Fire Hose.

The equipment of vessels of all kinds with hose that can be thoroughly relied upon for efficient service in case of urgent necessity, is a matter that is uppermost to-day in the minds of owners of steam and sailing craft of every description. In nothing aboard ship is quality more necessary nor a matter of greater concern than in the brand of fire hose used. It is not a difficult matter to secure definite information regarding the vari-

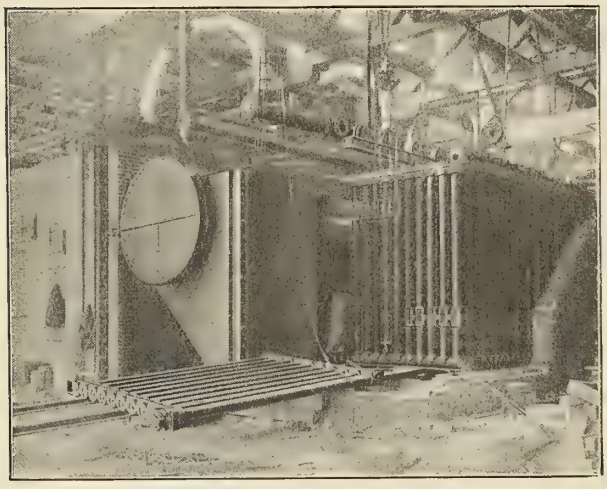
SECTION OF EUREKA FIRE HOSE.

ous brands of fire hose which are now on the market. The Eureka Fire Hose Company, 13 Barclay street, New York, N. Y., manufactures various brands of fire hose, one of which is illustrated on this page. This company, which claims to be the original and largest manufacturer of seamless-woven, rubber-lined, cotton fire hose, has supplied more than 1,700,000 feet of "Eureka" and "Paragon" fire hose to over 30 fire departments in the United States, and a single order from the New York city fire department aggregated 31,500 feet.

The "Eureka" fire hose, which is shown in illustration, is furnished in sizes from 1 to 4 inches internal diameter, and is what is known as a single-ply hose. It is a cotton hose, seamless-woven, and rubber-lined, and made milldew proof. The manufacturer states that this hose will stand a pressure of 350 pounds per square inch and is especially desirable for use where hose is kept attached to stand pipes, fire pumps, etc. The best hose is not expensive when we consider how much less the loss of life in the *Slocum* disaster might have been if that vessel had been equipped with some such hose as this.

Fuel Economizer.

The two most essential qualities of a fuel economizer are its ability to utilize most efficiently for heating water a maximum amount of heat from the escaping gases, and the accessibility of all surfaces for cleaning, repairing, and renewals. The Sturtevant economizers were designed to make possible these two requisites. By a system of staggered pipes the hot gases encircle each pipe, increasing the effective heating surface to a maximum. A fuel economizer must be accessible both inside and outside, and to make this possible the joints of the Sturtevant economizer are made taper metal to metal, specially suitable for high pressures, and are so designed that any pipe can be taken out and a duplicate substituted without disturbing any other pipe, section, or side walls. This would not be possible if packing, cement, or rusting were used to make tight joints. Any header or section can also readily be withdrawn and a duplicate replaced. There are no connection pipes to remove and all water surfaces are rendered accessible by the simple removal of the caps.



STANDARD ECONOMIZERS IN FURNACE FLUE.

The scrapers are interchangeable and the driving mechanism positive in action. A guide plate for the scrapers is used to insure the scrapers position and prevents them from sticking and breaking.

While the economizers are not designed for forced circulation, the connections are made in such a way that the flow of water is started in the right direction and tends to keep the flow up and down the consecutive sections without making undue work for the pump.

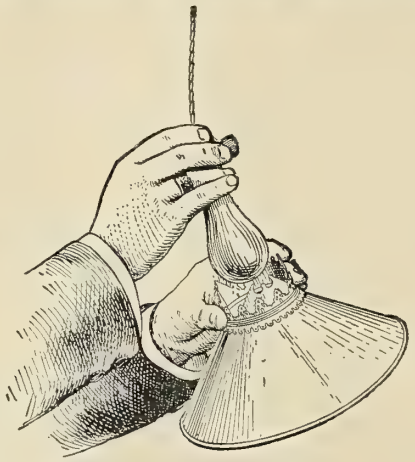
Two general types of economizers are made by the B. F. Sturtevant Company, Boston, Mass., the Standard and Pony, the former adaptable to power plants of almost any size, and the latter, as its name implies, is smaller and is more adaptable to power plants of 350 horse power or less.

All machines are made of the best cast iron for the purpose. All parts are tested to 350 pounds pressure before leaving the works and guaranteed to be sound and tight. All parts are machined to special gauges and kept in stock so that duplicates can be furnished without delay.

The several installations of these economizers are stated to have proven highly efficient; the gases are reduced to a very low temperature with a comparatively small amout of heating surface, and the water has also been heated to an exceptionally high temperature. In cases where the feed water contains foreign substances the owners have found these machines to be especially valuable owing to their accessibility and ease of cleaning.

An Automatic Lamp Shade.

The accompanying cut is of an improved lamp, made by the General Incandescent Arc Light Company, 529 West 34th street, New York, N. Y. The holder can be quickly attached and removed from any size electric lamp, from 4 to 24 candle power, without removing the lamp from its socket and adjusting itself automatically

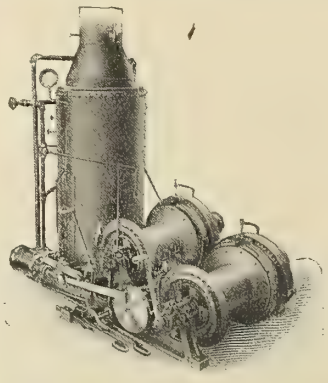


AN ADJUSTIBLE LAMP SHADE.

to the form of the lamp. The shades are light and ornamental, yet they are durable and made of water-proof cardboard, green on the outside and white inside. The holders are made in bright brass, nickle, or copper plated. The shade may be used on an upright or portable lamp equally well by simply bending the arms at right angles and adjusting from the inside of the holder.

Compact Hoisting Engine.

The cut on this page shows the double-engine and double-drum style of hoisting engine, mounted with boiler, made by the Stroudsburg Engine Works, Strouds-



DOUBLE-DRUM, DOUBLE HOISTING ENGINE.

burg, Pa. The effective points in this machine are its simplicity of construction, durability, and ease of

operation. In this make two winding drums are driven by friction cones with an improved arrangement of hardwood friction blocks. The drum is thrown into gear by forcing it against the wood friction surface by means of a screw, thrust pin, cross key and collar; the shaft is shouldered to take the thrust on the gear and the collar is screwed on the upper end to take the thrust against the bearing. The drum is forced out of engagement by simply throwing the friction levers back against the stop pin, no springs being required. The friction pins turn in an oil bath especially designed not to require close attention.

The cylinders have short stroke and each piston is designed for high-speed working. The cylinder drain cocks are simultaneously opened or closed by one lever. The slide valves are fitted to work against vertical valve seats; the cross heads are of the well-known locomotive type with brass gibs; the connecting rods have solid ends and are smooth forged with provision in the boxes for taking up wear. All engines are built on the duplicate system from complete sets of jigs and templates to insure perfect interchangeability. This style of machine is built in various sizes of hoisting capacity, with double blocks from 2 3-4 to 24 tons.

United States Shipbuilding Company Foreclosure.

On July 2, Judge Lanning filed a decree in the United States Circuit court, at Trenton, N. J., ordering the sale of the property of the United States Shipbuilding Company in the foreclosure proceedings instituted by the Mercantile Trust Company and the New York Security and Trust Company on the two mortgages held by them for $15,000,000 and $10,000,000 respectively.

The decree orders that these total amounts be paid within ten days by the Shipbuilding Company, in default of which received James Smith, Jr., is appointed a special master to execute the sale by decree by offering all the properties at sale, separately, to be disposed of to the highest bidder.

The minimum bids which Judge Lanning authorizes the reciver to accept, and aggregating $11,100,000, are as follows: Union Iron Works, California, $1,400,000; Hyde Windlass Company of Maine, $135,000; Bath Iron Works, Limited, of Maine, $300,000; Crescent Shipyard Company of New Jersey, $125,000; Samuel L. Moore & Sons Company of New Jersey, $175,000; Eastern Shipbuilding Company of Connecticut, $125,000; Harlan & Hollingsworth Company of Delaware, $550,000; Canda Manufacturing Company, $200,000. Patent rights, good will, trade marks, book accounts, accounts receiveable, contracts, promissory notes, drafts, checks, etc., $50,000.

Minimum bids on mortgaged personal property of the following companies may be accepted: Union Iron Works, $300,000; the Hyde Windlass Company, $100,000; Bath Iron Works, Limited, $40,000; Crescent Shipyard Company, $25,000; Samuel L. Moore & Sons Company, $30,000; Eastern Shipbuilding Company, $20,000; Harlan & Hollingsworth Company, $135,000.

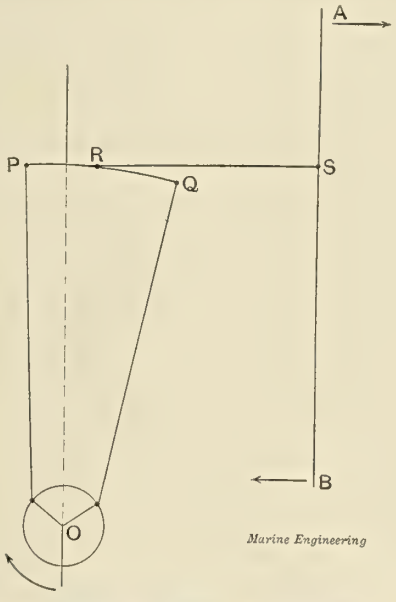
Three hundred thousand shares of the Bethlehem Steel Company, par value $50 a share, are to be disposed of for not less than $7,500,000. The decree specifies that the court may reject any or all bids or make such further orders as may prove necessary.

QUERIES AND ANSWERS.

Q. 220.—Will you please give me an insight into the principles involved in the operation of the valves of a steam-steering gear engine? R. L. H.

A.—The conditions to be fulfilled at the steering wheel are as follows:

So long as the wheel is at rest the steering engine must remain at rest and the helm fixed. If, then, the steering wheel is put over, say as for starboard helm, the engine must immediately start up in the corresponding direction and move the helm to starboard, continuing such motion as long as the wheel is moved, and stopping when the wheel stops; or, at least, running up to and stopping at the position which corresponds to the final position of the wheel when brought to rest. On the other hand, if the wheel is put over in the inverse direction, as for a port helm, the engine must start up in the corresponding inverse direction and move the helm over to port, and continue such motion so long as the wheel continues to move in this direction, in the same



manner as described for motion to starboard. The key to this complicated system of movements is found in the valve control of the engine. For a simple illustration of the principles involved let us suppose that the engine is controlled by a Stephenson link of the usual form, and that the link is so coupled up with the engine shaft by screw gearing or otherwise, that with the link thrown toward either end, the resulting motion of the engine will gradually move the link back to mid gear. Let the main items of this gear be represented in the diagram. The line *AB* represents a lever of which *A* denotes a point under the control of the steering wheel, and *B* a point under the control of the engine, as above noted. From *S* a connection is made with the link. Then with the engine at rest *B* is a fixed point, and movement of *A* to the right will throw the link to the right and out of mid-gear. The engine will thereupon start off with right-hand rotation moving the helm accordingly. Then when the wheel comes to rest *A* becomes a fixed point or center, and *B* is moved to the left by its connection with the engine. This results in throwing *S* to the left

and thus in finally middling the link and bringing the engine to rest. By moving *A* in the opposite direction a corresponding series of inverse movements will be set up and controlled. In this manner it may be seen that the various conditions above specified may be fulfilled.

In actual steering gears the Stephenson link and other connections are replaced by a variety of arrangements comprising reversing valves, movable eccentrics, etc., but all so adjusted as to bring about the same general series of movements. The Stephenson link is here used in illustration, not because it is commonly employed in standard types of steering gear, but because it is a familiar type of valve gear, and by its use the principles embodied in actual gears may be readily understood. With these principles clearly in hand any actual gear of the several types in common use may be studied intelligently, and the details of its operation readily made out.

Q. 223.—How much air is there in sea water?

(*b*) How does a ball nozzle work?

(*c*) How much oil used per horse power per hour in a modern triple-expansion marine engine?

(*d*) Why does a hot-water pipe freeze before a cold-water pipe under the same conditions?

(*e*) How would you strip a modern triple-expansion, vertical-inverted marine engine preparatory for a general overhauling?

J. H. H.

A. (*a*).—The proportion of air contained in average sea water may be estimated at about 20 parts by volume in 1,000. It may be noted, however, that the oxygen and nitrogen thus contained in water are not present in quite the proportion which constitutes atmospheric air. The proportion of nitrogen to oxygen in sea water is usually not far from 3 to 1, while in atmospheric air the proportion of nitrogen is somewhat higher. It may be further noted that the aeration of sea water is for the most part maintained by the lashing and agitation of the surface water by storms, and as seen in the familiar breaking wave crest. The foam, which is so familiar a feature of the breaking crest, is simply a mixture of air and water in such proportion that the water is no longer continuous, and comprises simply the film which constitutes the envelope of the air bubbles. Shortly after a storm the surface water is therefore highly aerated, and the contained air is then gradually distributed downward, thus maintaining a general average, as above noted.

(*b*) A complete explanation of the ball nozzle would require mathematical discussion of a character not suited to these columns. A fairly satisfactory understanding of its operation may be gained, however, by accepting the following principle: In a rapidly-moving jet or film of liquid the pressure is reduced far below the value which it would have with the liquid at rest and under the same head. This principle holds, likewise, with gases and vapors, and finds an important application in the De Laval steam turbine, where the pressure in the jet of steam is reduced, by its high velocity, from the full steam-pipe pressure to a value sensibly equal to that of the atmosphere. Accepting this principle it may be seen that the forces which act on the ball *B* may be grouped under four classes:

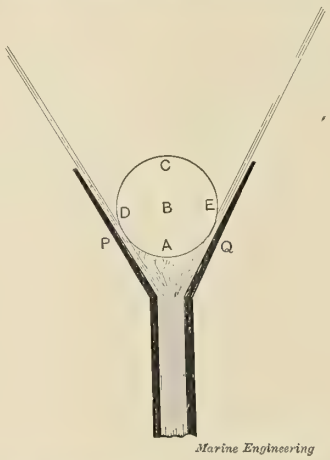
(1) Atmospheric pressure acting on the surface of the ball *D C E* and having a resultant acting from *C* toward *A*, and hence tending to hold the ball in the nozzle.

(2) The liquid pressure in the core of the liquid acting on the surface of the ball near *A* and tending to drive the ball out of the nozzle.

(3) The liquid pressure in the rapidly-moving film of liquid at *P* and *Q*, and acting on the surface of the ball near *D* and *E*, and having a resultant acting from *A* toward *C* and tending to push the ball out of the nozzle.

(4) The force due to gravity and represented by the weight of the ball. This force may act in one direction or another relative to the nozzle, according to the position of the latter, and so far as the present discussion is concerned may be left out of account.

Aside from the weight of the ball, then, the equilibrium of the ball in the nozzle means simply that, taking the action of the forces along the axis of the jet, force number 1 exactly balances the combined effect of numbers 2 and 3. It appears, furthermore, that within a somewhat narrow range of movement there is stability with regard to the position of the ball in the nozzle. That is, if the ball is moved outward in the direction *A C*, it will tend to return, and, conversely, if it is forced



inward in the direction *C A* it will, when left free, return outward to its position of equilibrium. This may be understood by reference to the changing values of forces 2 and 3. If we start with the ball close against the inner conical wall of the nozzle, then there can be no discharge at *P* and *Q*, and the ball is subject to the full static pressure of the liquid over the entire surface *F A Q*. It therefore moves outward, and once the film discharge established, we have the play of forces above noted. If the ball is forced in toward the bottom of the nozzle the pressure in the core of the jet becomes increased and pushes it out again. If, on the other hand, it is forced outward slightly the core pressure is further reduced, and the excess of atmospheric pressure will tend to carry it inward to the position of equilibrium. If, however, the ball is carried outward too far, the pressure within the film becomes increased, equilibrium is lost and the ball is driven outward on the moving jet. The operation of a ball nozzle is further modified by the rotation of the ball, and by the tendency of a film of liquid to curl and follow around the surface of the ball. The above partial discussion will, however, serve to show the more important fundamental principles which are exhibited in this interesting example of liquid discharge.

(*c*) Practice differs widely in the amount of lubricant required with modern marine machinery, but under average conditions from 5 to 8 pounds of oil per ton of coal, or from 5 to 8 pounds per 1,000 I. H. P. per hour will represent a fair allowance. In terms of liquid measure this will be somewhat less than one gallon per 1,000 I. H. P. per hour. In small sizes, or for engines of the torpedo-boat type, etc., the demand for oil will rise to considerably higher figures. Of the total amount required as above, some 5 to 10 per cent. will be used for internal lubrication, and the remainder for the various joints, bearings, etc.

(*d*) We have yet to learn on trustworthy evidence that such is the case. In supposed instances the conditions are presumably not the same.

(*e*) Questions of this character cannot be advantageously discussed in a "Query and Answer" column. There is no one routine which is absolutely essential, and the method or routine to be adopted in any individual case would depend in very large measure on the special circumstances, including in particular the style of engine and character of overhaul. Good common sense, with a perfectly clear understanding of just what is to be done, will be found worth far more than any amount of thumb-rule directions in engineering operations of this character.

Q. 224.—Would you kindly inform me, through your question column, what the surface ratio is to the disk area of propellers on tug boats? Also, what relation it bears to the immersed midship section? There seems to be a tendency on the Pacific coast to have the surface ratio high, about .52 to .55 of the disk area, and therefore, as this seems high, I would like your views on this subject.

When delineating a propeller, is it not correct to advance the point *B* beyond the point *A*, the amount of the throw-back of the blade, as *C*, *E*.? A. DE B.

A.—The surface ratio with tug-boat propellers is usually close about .50; sometimes more and sometimes less. This proportion has been worked out as the result of experience with such propellers, and in the general belief that some such area ratio will give all the thrust

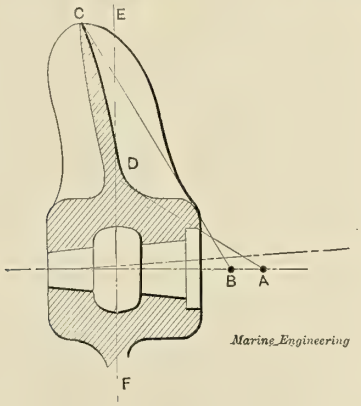


FIG. 1.

that can be expected on the given diameter. Recent experiments on model propellers at Sibley College, Cornell University, have thrown new light on these questions, and have served to show the limit of useful area. In agreement with the indications of theory it was found that this limit is reached earlier with propellers of low pitch ratio than with those of high pitch ratio. With propellers of about 1.1 pitch ratio there is little gain in thrust beyond area ratios of .40 to .45, while with propelers of 1.5 pitch ratio or upward, increase of area brings with it increase of thrust up to area ratios of .55 to .65. In such case, however, the gain for the additional area above .50 ratio is very slight, and in general it may be assumed that a propeller with an area ratio of .50 will give substantially all the thrust which can be expected under usual conditions of operation, and that any further increase in area will not bring with it any essential increase in thrust.

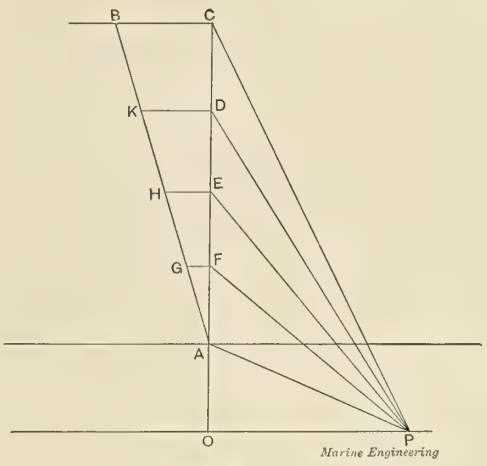


FIG. 2.

The question of the influence of area on efficiency is a further important part of this general problem, but its discussion in detail would take us beyond present limits of space. It will suffice here to state that in general the propeller is not sensitive in efficiency relative to changes in area. That is, at average values of the slip and under average working conditions, considerable changes may be made in area with but slight influence on the efficiency of operation. In particular it has been shown by these experiments that under usual working conditions there is no serious loss in efficiency due to an increase in area up to ratios of about .50, and that, in consequence, such area ratios may be freely employed without incurring any serious loss in the economy of propulsive operation.

Regarding the delineation of a propeller, the methods employed are largely arbitrary, and it should be remembered that the only purpose of the drawing is to give to the pattern maker or founder the information which he will require in order to make the pattern or sweep up the mould in the sand. If we assume that the propeller is to be of uniform pitch but with blades bent back at a certain angle, the simplest method of getting the guide-iron angles is that indicated in Fig. 2. Let *A B* be the center line of the blade tipped back as shown. Then the distance *O P* is laid off on the shaft center line equal to pitch ÷ 6.2832. Then draw *A C* at right angles to the shaft center line and take any series of points *A, F, E, D, C* on this line and draw from them lines to *P*. Then the angles *P A O, P F O, P E O,* etc., will give the guide iron angles for corresponding points on the blade at *A, G, H, K,* and *B*.

So far as your question is concerned, it would be

correct, in laying out the propeller as you have indicated, to make *A B*, Fig 1, equal to *C E*, but this method has the disadvantage that for other points on the blade intermediate between *C* and *D* it is necessary to take likewise intermediate points between *A* and *B*. With the method suggested above, however, all oblique lines are drawn from the same point *P*, and the guide iron angle, or inclination of the blade to the transverse plane, may thus be readily determined for any point on the blade or for any radial distance outward from the axis, in the manner as illustrated in the figure.

Q. 226.—Please advise the best and most prudent way to get grease out of Scotch boilers in both instances: first, where the boiler is very sensitive when sal soda is used; and second, when no inconvenience is suffered from the use of sal soda so far as priming is concerned. E. R.

A.—Instead of getting oil out of your boiler it is far better to keep it from getting in. If, however, oil does enter a boiler in any considerable amount, serious trouble is liable to result, and some means must be employed to minimize the danger. The function of soda is to form a combination with oil which does not adhere to the heating surfaces and which is not likely to produce the bad results due to oil alone. In particular is this the case with animal oils, which with soda form a soap which is soluble in the water of the boiler, and thus does no further damage. In modern practice, however, it is rare to get animal oils into the boilers, because there is danger, if soda is not present, of the separation of the oil into a fatty acid and glycerine, the former of which may attack the plates of the boiler with serious corrosive results. Due to this well-known fact modern internal lubricants are entirely of mineral oil which does not break up in this way, and the oil finding its way into modern steam boilers is therefore of this character.

Where a boiler is tender as regards foaming, soda may tend to aggravate this condition, and it may be necessary to discontinue its use. In such case the best policy would be to install an oil filter and keep the oil out of the boilers entirely, keeping careful watch by timely inspection as to the internal condition in this respect. In any case, as noted at the start, an oil filter is the best means of dealing with oil in feed water. It is here, as elsewhere, "prevention is better than cure."

A.—229. In answering this question in the July number, the authority from which Fairbairn's tests are taken, should be the Philosophical Transactions of the Royal Society of London of 1858. We are indebted to Mr. P. K. Thurston for calling our attention to this oversight.

Q. 230.—Through your Q. and A. column will you please answer, or at least modify, the following problem, to conform to good, current practice? It is desired to ascertain the proper size of boiler, with necessary grate and heating surface, for a fore-and-aft compound-condensing marine engine, 12 and 26 inches by 12 inches, cutting off at 8 inches in the H. P. cylinder and making 200 R. P. M. While it may not be the most economical cut-off to use on such a machine, it is desired to compute boiler dimensions large enough to sustain this cut-off. All figures are to be based on natural draft and a boiler pressure (gage) of 150 pounds.

In "Drawing and Designing for Marine Engineers," by Roberts, Tower Publishing Company, London, there appears this computation, which the writer copies:

Area 12-inch cylinder = 113.1 square inches.
Weight steam at 165 pounds (absolute) = .3714.
Then pounds of steam per hour,

$$\frac{113.1 \times .7854 \times 8 \times .3714 \times 200 \times 2 \times 60}{1{,}728} = 3{,}665.67.$$

For losses in piping, ports, passages, etc., Roberts adds 40 per cent. additional, or $3{,}665.67 \times 1.4 = 5{,}131.938$ pounds of steam per hour. For water to be evaporated for this steam his formula is

$$5{,}131.9 \ \frac{(1{,}224.9 - 140)}{966.1} = 5{,}762.$$

In practice he allows 15 pounds of coal to be burned on each square foot of grate; and 9 pounds of water to be evaporated on each square foot of grate.

Then, from this, grate surface $= \frac{5{,}762}{15 \times 9} = 42.68$ square feet.

Is 40 per cent. really more than necessary, for losses, in good average practice? Can more than 9 pounds of water be evaporated, in ordinary practice, with ordinary coal, or, say, seasoned wood fuel? Eliminating the types of externally fired and the pipe boilers, and being allowed 6 1-2 feet as the maximum athwartship space available for a boiler, what types of boilers could be employed whereby the necessary grate surface could be obtained, with some form of internally-fired boiler? The writer has frequently heard it asserted by steamboat men that on a given width and where a boiler is fired only at one end, the fire-box type will admit of more grate surface than the regular Scotch types. Suppose the problem to be a little further reduced: that the boiler must be of the fire-box type having a circular fire box and fir wood being the fuel; that no grates are to be used, the internal-fired Scotch "wood burners" not requiring or using grates in this section, and the outside shell not to be over 6 1-2 feet diameter, as before. With a 3-inch "water leg," as required by law, what proportion of the internal circumference of the furnace or fire box could be taken as width in figuring the grate surface? A. R. C.

A.—We have looked through the book you mentioned but do not find the same example as you present. However, on page 141, "Drawing and Designing," are given formulas for an 18-inch engine. We presume that you have endeavored to change the formula to your case of a 12-inch engine. In your copy the constant, which we have placed in italics, should be omitted. This is used to determine the area of the cylinder when the diameter is given, and you have already found the area. The area of a cylinder = the diameter^2 × .7854, or the radius^2 × 3.1416. This correction will make considerable change, and your figure for the pounds of steam per hour will be 4667. In carrying this correction through the other steps of the example, the grate surface should be 54 1-3 square feet.

In looking carefully over your example we beg to suggest that before using a formula you satisfy yourself what each figure represents. This is quite a general mistake and ofttimes leads to serious blunders. You state "weight of steam at 165 pounds absolute"; this should properly be stated as weight of one cubic foot of steam at 165 pounds absolute. Again, the formula for water evaporated should be understood before using. It means that the feed water enters the boiler at 140 degrees. This formula is simply for reducing the steam evaporated to a standard basis; that is, the water at 212 degrees evaporated into steam. The fractional part of the expression is called the "factor of evaporation," and while it may be calculated for each and every case, it will be found in tables dealing with steam. You have quoted your authority inaccurately concerning the grate surface, and the expression should read, " 9 pounds of water evaporated *per pound of fuel.*"

Now, concerning the second part of your query: 40 per cent. loss in piping, port passages, etc., is excessive. It probably includes steam used for auxiliaries such as steam pumps and air pumps. While 9 pounds is not an excessive evaporation per pound of coal, it is good practice, but the heating value of coal is much greater than wood, even when the wood is seasoned. Roughly, 2 1-4 pounds of dry wood should evaporate the same amount of steam as one pound of the average quality of soft coal. The contention that the fire-box type of boiler will give more grate surface per foot width of boiler than the Scotch type is very true. The most efficient boiler to suit your conditions was described on page 480 of the September, 1903, issue of Marine Engineering. In it corrugated furnaces are used, but placed inside water drums only slightly larger in diameter than the furnace. But the space between the two shells is connected at the front and back with a large drum above. This permits of large grate surface per foot width, good circulation, and easy steaming. We do not exactly understand your last statement with reference to circumference of furnaces in figuring the grate surface. Presuming that you intended to use the word "diameter" in place of "circumference" would state that the diameter for calculating grate surface should be the least inside diameter.

From the nature of your question it appears to us that you are desirous of getting better posted on marine-engine design, and we would, therefore, heartily suggest that you take up and study some of the standard books on this subject.

Q. 231.—Will you be so kind as to solve the following example in your magazine:

A propeller at 100 revolutions and 20 per cent. slip gives a speed of 18 knots per hour. What will be the speed at 120 revolutions per minute and 25 per cent. slip? C. E. P.

A.—The speed of a ship may be determined by the revolutions of the engine, pitch of the propeller, and the slip. By pitch is meant the longitudinal distance which the propeller would travel in one revolution were it working on a smooth unyielding surface, such as a nut.

Your problem may be solved either by first determining the pitch from the first statement, using that to determine the speed in the final question, or by a simpler and surer method depending upon the ratio of the different factors.

Let us explain the problem fully by the first method: 1 nautical mile = 6,080 feet. Therefore, at a rate of 18 knots, the vessel has traveled 109,440 feet in one hour, or 1,824 feet in 1 minute. Now, while the ship has gone this distance, the propeller has gone (figuratively) a distance = 100 ÷ (100—20) = 1.25 this amount, or 2,280 feet. In one minute the propeller made 100 revolutions and therefore the pitch of the wheel is 2,280 ÷ 100 = 22.8 feet. At a slip of 25 per cent. the speed of propeller is 100 ÷ (100—25) = 1.33 times speed of boat, and at 120 revolutions, speed of boat is,

$$\frac{22.8 \times 120 \times 60}{6{,}080 \times 1.33} = 20.3 \text{ knots.}$$

The shortest method by means of ratio or proportion is based upon the fact that the speed is directly proportional to the revolutions and inversely proportional to the slip. Letting x be the required speed then:

$$18 : x = \frac{100}{1.25} : \frac{120}{1.33};$$

$$\text{Therefore, } x = 18 \times \frac{120}{1.33} \times \frac{1.25}{100} = 20.3 \text{ knots.}$$

Q. 232.—Will you please inform me how I can work out the horse power of a Scotch boiler? Also, explain about the different kinds of tonnage to which a ship is subject and the definition of same? E. S. A.

A.—The horse power of a boiler may be expressed in terms "boiler horse power," the unit being 34.5 pounds of water evaporated from and at 212 degrees Fahrenheit into steam, or it may be stated in terms of indicated horse power of the engine. On board ship the latter method is generally adopted. The power of the boiler depends on the amount of grate surface and the amount of heating surface in the boiler, the other elements being given due consideration of course. In order to produce steam coal must be burned, and, therefore, the area of the grates is the primary factor determining the boiler power. With good natural draft every square foot of grate should give from 7 1-2 to 10 indicated horse power at the engine. The heating surface is so proportioned that the total surface of the tubes, combustion chamber, and effective surface of the furnaces should aggregate 30 to 40 times the grate surface. In good practice 1 I. H. P. should be produced on 2 1-2 or 3 square feet of heating surface.

While strictly speaking there are but two different kinds of tonnage of a ship, the gross tons and the net or registered tons, the dead weight carrying capacity and the displacement are ofttimes confused. The gross tonnage is the capacity measurement of the vessel expressed in tons of 100 cubic feet each. It is found by multiplying the length at the load line, measured from the front of the stem to the back of the stern post, by the extreme breadth of the outside of the plating by the depth from the upper deck amidships to the top of the keel. Each of these dimensions is to be expresed in feet, and the product is to be multiplied by a factor varying from .6 for high-speed steamers and sailing ships to .8 in cargo steamers, and the result divided by 100. To this are to be added spaces under tonnage deck, spaces between tonnage and uppermost deck, and all closed-in spaces, such as poop, forecastle, officers' cabins, cargoes, deck houses, wheel houses, and other closed-in spaces employed for working the ship. Certain deductions are permitted from this total, which are: berth accommodations for the crew in the forecastle or elsewhere, not including spaces for stewards and passenger's servants, berthing accommodation for the officers, except the captain, galleys used exclusively for the crew, and closed-in spaces above the uppermost deck employed for working the ship. In none of these spaces must cargo be carried or passengers berthed, and the total deduction under all these heads must not exceed 5 per cent. of the gross tonnage.

The net tonnage allows certain other reductions necessary for the working of machinery in steamships, which include the engine and boiler-room spaces, and the casing or hatches of these two compartments, and shaft trunks in screw steamers. The sum of these volumes in cubic feet divided by 100 gives the tonnage in machinery space. If this tonnage in screw steamers is above 13 per cent. of the gross tonnage and under 20 per cent., the total

deduction permitted for machinery in coal space is 32 per cent. of the gross tonnage. In the paddle steamers if the measured space has a tonnage of over 20 per cent. and under 30 per cent. of the gross tonnage, the total deduction permitted is 37 per cent. Should the machinery space fall below 13 per cent. or above 20 per cent. of the gross tonnage the deduction from the gross tonnage to be made is to be 50 per cent. more than the measured space in paddle steamers and 75 per cent. in screw steamers.

The above are the rules as laid down for international tonnage and generally accepted by all the maritime nations. The Suez canal dues are fixed, however, on a somewhat different basis of tonnage measurement.

The displacement is the exact weight of the ship measured in tons, and it generally is stated for load conditions.

The dead weight carrying capacity is the number of tons of cargo and coal which the ship will carry at load draft. Another way of expressing it is the tons required to lower the vessel when at light draft with bunkers and cargo spaces empty, to load draft mark.

Q. 234.—Will you kindly tell me how many expansions there are in a marine compound engine? Also, what is meant by expansion? and oblige, READER.

A.—We will take your second query first.

By expansion is meant the number of times that the steam expands from the point of cut-off in the high-pressure cylinder until it is exhausted from the low-pressure cylinder. It is evident that when the steam port is closed the steam increases in volume during the rest of the stroke in the high-pressures and continues expanding in the following cylinders. The volumes of the cylinders vary as the square of the diameter, the stroke, of course, being the same. In a compound, the ratio of the diameters of the high and low cylinders is about as 1 to 2, or the ratio of the volumes as 1 to 4; in a triple-expansion engine the ratio of the volumes of the high to the low pressure is as 1 is to 7 or 8. Now, if cut-off takes place at two-thirds of the stroke, the total number of expansions in a compound will be about $4 \div 2\text{-}3 = 6$; in a triple about 11 or 12.

Q. 235.—An analysis of the interesting race between the *Kanawha* and *Hauoli*, given in your July number, would seem to indicate that the *Hauoli* was improperly fitted to her propeller.

It will be observed that the 24-inch stroke engine of the *Kanawha* managed to make 305 revolutions, or 1,220 feet piston speed, with propellers of 9-feet pitch.

On the other hand, with the same steam pressure and 3 inches shorter stroke, the *Hauoli* was only able to make 290 revolutions, or 1,015 feet piston speed, because her single propeller was 9 feet 6 inches pitch.

Is it not safe to assume that if the *Hauoli* propeller had been 8 feet, or 8 feet 6 inches pitch, the race would have turned out differently? H. S. W.

A.—Since the July issue went to press we have been able to gather the exact data of the *Hauoli's* performance in the race with the *Kanawha*, through the courtesy of the designer of the former, Mr. H. J. Gielow. There is also a correction in the pitch of the wheel as stated in table below.

While you assume that a different propeller on the *Hauoli* would have given different results, doubtless is true; the same would also be true of the *Kanawha*. You have taken it up from the wrong point. An engine may be so designed that although she runs at less piston speed, it will be of greater power than a second engine of greater piston speed. It is possible to design two propellers to give the same efficiency, one running at high revolutions and the other at low revolutions, to drive the boats at the same speed.

For purposes of comparison we repeat some of the data stated in the July issue, and have added thereto the pitch ratio, the apparent slip, and the probable true slip calculated from an assumed wake factor. This true slip is in both cases excessive, and shows that the propellers were running at low efficiency and were doubtless not designed for the high revolutions attained on the race; as seen the probable true slip greatly exceeds that of the calculated true slip which may safely be assumed for these propellers.

	KANAWHA.	HANOULI.
ENGINES:	Two triple.	One 4-cyl. triple.
Cylinder diams.,	14 1-2, 24, 42 ins.	17, 26 1-2, 30, 30.
Stroke,	24 ins.	21 ins.
Revs. average,	305.	302.
Piston speed,	1,220 ft.	1,057 ft.
PROPELLERS:	Two, 4 blades.	One, 3 blades.
Pitch,	9.0 ft.	9.2 ft.
Diameter,	7.3 "	6.7 "
Pitch ratio,	1.23.	1.37.
Speed of ship,	19.9 knots.	19.53 knots.
Apparent slip,	26.5 per cent.	28.8 per cent.
Wake factor, assumed,	6 " "	13 " "
Calculated true slip for maximum efficiency,	20 " "	21.2 " "
True slip, actual,	30.9 " "	38.1 " "

Q. 236.—I would be much obliged if you would state in your next issue of MARINE ENGINEERING what are Tchebycheff's rules (1) of two ordinates, and (2) of three ordinates for the spacing of ordinates for the calculation of a ship's displacement, center of buoyance, and stability? These rules I have not been able to find in the technical text books. A. J. C. R.

A.—Tchebycheff's is an approximate rule for ascertaining the area of an irregular surface. In most of the rules ordinates are laid off at equal distances apart and their values are multiplied by special coefficients. The products of all ordinates are added and the sum multiplied by the distance between the ordinates; the result is the area. Now, in the Tchebycheff rule, the end ordinates are unequally spaced so as to require no special multipliers.

You will find this and other rules for integration stated in Professor Peabody's *Naval Architecture*.

For a discussion of these rules we refer you to the paper read before the Northeast Coast Institution of Engineers and Shipbuilders by Mr. F. H. Alexander and printed in volume xix., part 5 and 9 and volume xx., part 1. The address of the secretary is 4 St. Nicholas building, Newcastle-on-Tyne.

Q. 237.—Would you kindly tell me the proper diameter of the paddle wheels, with width and depth of buckets, for a small boat of 20-feet length, 4-feet beam, and 1-foot draft? Also if you know of some book telling about stern and side paddle-wheel boats. Do you know any directions for making a planimeter? S. W. W.

A.—In the absence of full particulars of your engine and the speed desired, we cannot work out your problem. but quote the following formula from *Seaton's Handbook:*

Let K = speed of vessel in knots.
S = percentage of slip, say 25 per cent.
R = intended number of revolutions per minute.

Then diameter of wheel $= \frac{K\ (100 + S)}{314 \times R}$,

number of floats $= \frac{60}{\sqrt{R}}$,

and area of one float $= \frac{\text{I. H. P.}}{D} \times .2$.

The breadth of the float should be about one-fourth of the length and the immersion should be about one-sixth of the breadth. We would refer you to the Handbook above mentioned for further rules and information.

A little book published by H. S. H. Shaw on the planimeter gives a general explanation of this instrument.

Heating Feed Water.

Editor Marine Engineering:

Referring to Query No. 195, page 138, in your March issue, and correspondence on page 296 in your June number, relating to feed-water heating, I have to point out that in heating feed water by auxiliary exhausts in a tubular feed heater, its temperature will hardly be raised more than 20 degrees (say from 120 degrees to 140 degrees), as the quantity of the exhausts must necessarily be much smaller than that of the feed water, and only the "sensible" heat of the former is transferred to the latter.

By using a heater with live steam injection, such as "Weir's," both the sensible and latent heat of the steam is transferred to the feed water; hence a small quantity of steam will heat the fed water to a high heat (200 to 240 degrees). The live steam can be taken from the low-pressure receiver, where it has already done work in the preceding cylinders. This is very ably set forth in an article by Professor A. C. Elliott, in London *Engineering*, vol. 59, pages 63, 97, and 191.

That the efficiency of the boiler will be better, with feed heated to such high temperature, is evident, and the unequal expansion and contraction of boilers so destructive to riveted joints and other parts will also be avoided. John Haug.

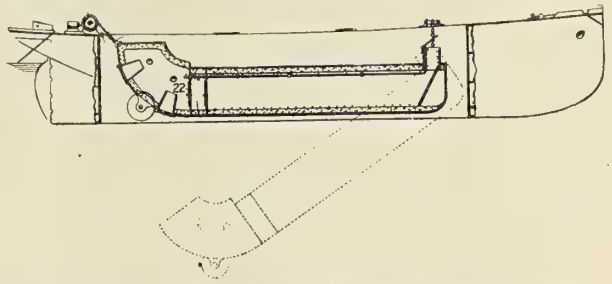
We fully agree with Mr. Haug in his above comments, except his first statement that only sensible heat of the steam is transferred to the feed water in a contact heater. This is a mistake, for it is impossible to remove the sensible heat of steam without partially condensing it or lowering the pressure, and in lowering the pressure from say 8 to 4 pounds, which is an outside figure, the temperature would be reduced but 10 degrees, a drop which would not correspond to the increase in the feed temperature. What does take place in a feed-water heater is exactly similar to that in a condenser. It is known to all that to condense steam the latent and part of the sensible heat is removed, which is the action that takes place in the condenser. Now, the transfer of heat from the steam to the water will not take place as rapidly or as efficiently when said heat has to pass through an iron surface as when the steam and water are brought into direct contact. It is for this reason that the efficiency of the surface heater is so much lower than a direct-contact heater. The best practice in high-pressure plants embodies now the use of the multiple-stage heater for reasons stated by Mr. Haug.

SELECTED MARINE PATENTS.

36,958. STEERING WHEEL. ALLEN W. HOLMES AND HIRAM C. HOLMES, MIDDLETOWN, CONN.

Claim.—The ornamental design for a steering wheel. One claim.

760,457. WORKING VESSEL. SIMON LAKE, BRIDGEPORT, CONN.



Claim.—2. A normally closed tubular structure permanently ballasted sufficiently to destroy buoyancy and having at one end a hatch upon the upper side and at the opposite end a diver's chamber or compartment with a bottom door for establishing communication with the exterior, and provided upon its exterior at both ends with means whereby it may be supported by external means at varying angles with the surface of the water. Seven claims.

760,518. PROPELLING SHIPS. ERNST BOHN, BERLINCHIN, IN NEUMARK, GERMANY. One claim.

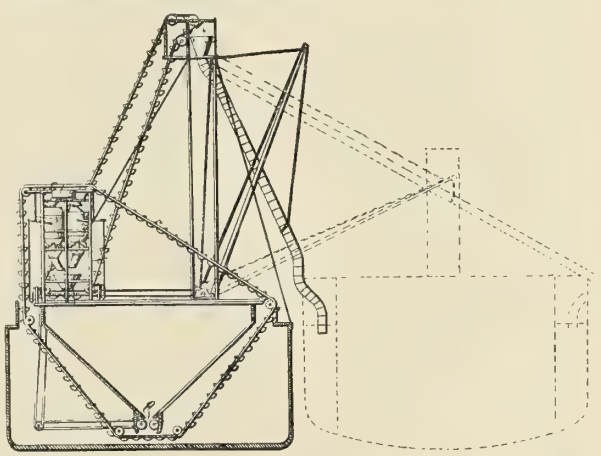
760,535. APPARATUS FOR RAISING SUNKEN VESSELS. DAVID C. GROVES, DUNEDIN, AND ALBERT R. STANTON, SOUTH DUNEDEN, NEW ZEALAND.

Claim.—2. Apparatus for the purpose indicated comprising in combination a tube secured to a vessel and communicating with the interior thereof, superposed independently actuated valves within the tube, means between the valves for breaking a receptacle for calcium carbid within the tube, and a pipe fixed to the vessel and projecting into the interior thereof for the discharge of water therefrom. Two claims.

760,754. SECTIONAL SHELL. GEORGE H. POOR, CHICAGO, ILL. Four claims.

760,758. BOAT PROPELLER. CHARLES F. RITCHEL, BRIDGEPORT, CONN. Four claims.

760,934. APPARATUS FOR COALING BOATS. HENRY D. STEARNS, NEW ORLEANS, LA.



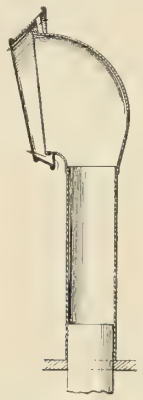
Claim.—Apparatus and means for coaling boats, consisting of the combination with a coal barge divided into separate bins, of a conveyer extending down into the barge and under the said bins, a weighing machine on the barge, located adapted for receiving the elevated coal, a second conveyer arranged for conveying coal from the weighing machine to an elevated position, a chute into which the weighed and elevated coal is delivered, a beam, windlass, and ropes whereby the said chute is adjustably supported, crushers between the lower conveyer and outlet openings in the said bins, a source of power on the barge, shafting and suitable connections through which driving power is conveyed to the said windlass, elevators and crushers, and means whereby the driving power may be cut off. One claim.

761,115. CENTER BOARD. CLAUDE B. WAINEWRIGHT, VANCOUVER, CANADA.

761,620. SHIP'S COWL. CHARLES A. WITHERS, AUGUSTA, GA.

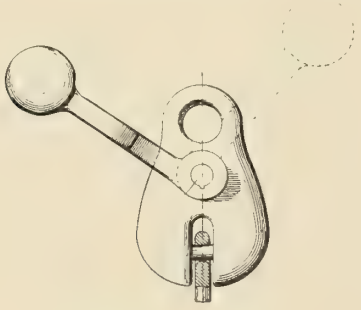
Claim.—1. A ship's cowl comprising an upper section forming a mouth portion, and a collar surrounding and connected to the upper end of said upper section, said collar gradually increasing in width upwardly, said collar projecting inwardly at an inclination, the inclination of the upper portion of the collar being greater than the lower portion, the upper portion of the said collar projecting over the mouth of said upper section, said col-

lar further projecting away from the mouth of said upper section and said collar in connection with said upper section forming an air passage for detecting the air across the mouth of said upper section. Two claims.



761,630. RECORDER FOR BELL BUOYS. JOHN A. FAIRBANKS, CAMBRIDGE, MASS. One claim.

761,809. DETACHING DEVICE FOR LIFE BOATS. ANTHONEY N. ANDERSON, JACKSONVILLE, FLA.



Claim.—2. A detaching device, comprising a block having a segmental recess and a boltway, a locking bolt in the latter, an angularly-movable arm in the segmental recess connected to the bolt to actuate the same, a pivot pin in said arm connected thereto for partial revolution independently thereof, and a weighted lever attached to the said pivot pin. Two claims.

761,835. BOAT. JOHN P. HICKEY, WASHINGTON, D. C. One claim.

762,040. ELECTRICAL CONTACT MEANS FOR SHIPS' COMPASSES. BERNHARD FREESE, DELMENHORST, GERMANY. Four claims.

762,134. CURRENT MOTOR. CHARLES O. BURCHIM, SIOUX CITY, IOWA. Twelve claims.

762,242. ANCHOR. CHAS. MITCHELL, SOUTHAMPTOM, ENGLAND.

Claim.—An anchor of the character described, composed of a shank having a ball formation at one end, an oscillating or turnable head mounted thereon, and composed of an annular piece and a socket piece secured to said annular piece, said annular piece being provided with flukes and with webs. One claim.

762,498. VENTILATOR FOR SUBMARINE BOATS. LAWRENCE Y. SPEARS, GREENPORT, N. Y.

Claim.—1. A submarine or submergible boat, having a ventilator pipe extending upward through its hull, said pipe being provided interiorly of the boat with means for preventing the influx of water therethrough and exteriorly of the boat with a hinge joint, and means operatable from the interior of the boat for folding down and erecting the ventilating pipe.

2. A submarine or submergible boat, having an upright ventilator pipe extending through the hull or shell of the boat and having a hinge joint exteriorly to the boat, a cut-off valve in said pipe interiorly of the boat for closing the passage through said pipe, a toothed segment on the pin of the hinge joint, an arbor extending upward through the hull of the boat, a worm on said arbor and gearing with said segment, and means inside of the boat for rotating said arbor. Two claims.

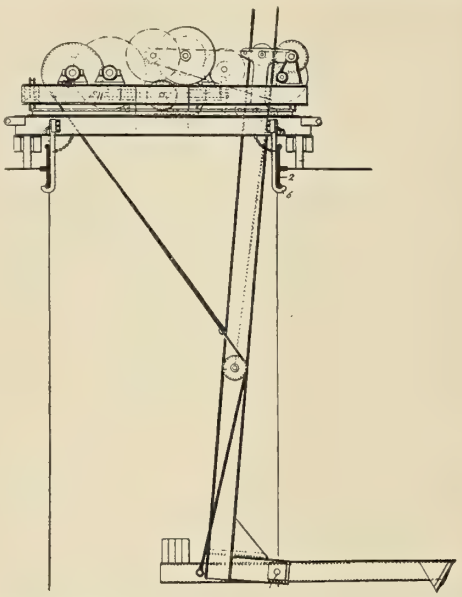
762,687. MEANS FOR PROPELLING SHIPS. WILLIAM COCHRANE, LONDON, ENG. Three claims.

762,710. GROUND ANCHOR. GEORGE HALL, LIMA, OHIO. Four claims.

762,736. GOVERNOR FOR MARINE ENGINES. JOHANNES MATTHIESEN, DARMSTADT, GERMANY. Four claims.

762,785. MECHANISM FOR GATHERING BULK CARGOES BENEATH HATCHES. CHARLES H. WELLMAN AND JAMES E. A. MOORE, CLEVELAND, OHIO.

Claim.—1. In mechanism for gathering bulk cargo beneath a hatch, the combination of a structure mounted over the hatch,



with a beam having a bracket pivotally mounted upon said structure so as to swing laterally, said beam extending down into the hold and being provided at its lower end with a hoe or scraper. Sixteen claims.

762,790. MEANS FOR WORKING SHIPS. WILLIAM WILLIAMS, OAKLAND, CAL.

Claim.—10. The combination, with the masts of a ship, of yards suspended therefrom, sleeves revoluble upon the yards between the center and ends thereof, sails attached at their upper edges to the sleeves, means for revolving the sleeves to furl the sails, means for extending the lower edges of the sails and connecting them with the yard below when set, carriers and rollers carried thereby, said rollers engaging the inner edges of the sails, and vertical guides upon which said carriers are slidable in unison with the furling and unfurling of the sails. Thirteen claims.

762,842. GROUND ANCHOR. ROBERT H. POLK, BIRMINGHAM, ALA. Eleven claims.

PERSONALS.

Professor W. F. Durand, head of the school of marine engineering at Cornell, and acting-director of Sibley College, has accepted the chair of mechanical engineering at the Leland-Stanford University of California.

George F. Johnson, formerly with the Pacific Coast Machinery Company, Seattle, Wash., has removed to Dawson, Yukon Territory.

J. August Reeves, who has been connected with the launch business for many years, has accepted the position of superintendent and assistant manager of the Western Launch and Gas Engine Works, Mishawaka, Ind.

As a result of the competition for architecture for the United Engineering building, Herbert D. Hale, of Boston, and Henry G. Morse, of New York, as associate, were chosen. The successful competitors for the Engineers' club are Whitfield and King, of New York.

Hon. Paul Morton, vice-president of the Atchison, Topeka and Santa Fé Railroad, has been appointed Secretary of the Navy to succeed Hon. William H. Moody, who is now Attorney-General. Secretary Morton is the eldest son of the late Hon. J. S. Morton, Secretary of Agriculture in Cleveland's second administration, and is well known among western railroad managers and in the republican party.